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Lead Agency:

**United States Department of the Interior
Bureau of Land Management
Carson City District Office**

Cooperating Agencies:

- U.S. Fish and Wildlife Service
- U.S. Environmental Protection Agency
- U.S. Army
- U.S. Geological Survey
- U.S. Bureau of Indian Affairs
- Pyramid Lake Paiute Tribe

Draft Environmental Impact Statement

Bedell Flat Pipelines Rights-of-Way Washoe County, Nevada

May 1993

The Bureau of Land Management is responsible for the stewardship of our public lands. It is committed to manage, protect, and improve these lands in a manner to serve the needs of the American people for all times. Management is based on the principles of multiple use and sustained yield of our nation's resources within a framework of environmental responsibility and scientific technology. These resources include: recreation; rangelands; timber; minerals; watershed; fish and wildlife; wilderness; air; and scenic, scientific, and cultural values.



United States Department of the Interior

BUREAU OF LAND MANAGEMENT

Carson City District Office
1535 Hot Springs Rd., Ste. 300
Carson City, NV 89706-0638



N-51606
1792/2800
(NV-03337)

APR 26 1993

Dear Reader:

Enclosed for your review and comment is the Draft Environmental Impact Statement for the Bedell Flat Pipelines Rights-of-Way. It analyzes an application submitted by Washoe County, Nevada, to the U.S. Bureau of Land Management, Carson City District Office, Nevada, for two rights-of-way across public land.

The Bureau of Land Management (BLM) is the lead agency for this EIS. Cooperating agencies are the Fish and Wildlife Service, the Bureau of Indian Affairs, the Environmental Protection Agency, the Sierra Army Depot, the U.S. Geological Survey and the Pyramid Lake Paiute Tribe.

The BLM and its cooperating agencies would appreciate your review of this draft document to see that it includes important issues and analyzes environmental impacts. The goal of the BLM and its cooperating agencies is to prepare a comprehensive analysis of the impacts of this proposal in order to fully inform the public and decision makers before any action is taken on the right-of-way application. Please send written comments to: James M. Phillips, Lahontan Area Manager, U.S. Bureau of Land Management, 1535 Hot Springs Rd., Suite 300, Carson City, NV, 89706-0638 by July 23, 1993.

If you prefer to comment in person, you are welcome to attend these public hearings:

1. June 23, 1993, in Reno, Nevada, at the Holiday Inn, 1000 East 6th St., 7:00 p.m.
2. June 24, 1993, in Susanville, California, at Lassen High School, 7:00 p.m.

We encourage your participation and appreciate your interest in the management of your public lands.

Sincerely yours,

Billy R. Templeton
State Director, Nevada

#28301263

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**DRAFT
ENVIRONMENTAL IMPACT STATEMENT**

**BEDELL FLAT PIPELINES RIGHTS-OF-WAY
May, 1993**

Lead Agency:

U.S. Department of the Interior, Bureau of Land Management

Cooperating Agencies:

**U.S. Department of the Interior,
Fish and Wildlife Service**

**U.S. Department of the Interior,
Bureau of Indian Affairs**

**U.S. Department of the Interior,
Geological Survey**

U.S. Environmental Protection Agency

U.S. Army, Sierra Army Depot

Pyramid Lake Paiute Tribe

Abstract:

This Draft EIS analyses Washoe County's proposal to obtain rights-of-way from the U.S. Bureau of Land Management to cross public lands with a buried water pipeline and a buried natural-gas pipeline. The water pipeline would be used to transport 13,000 acre-feet per year of groundwater from Honey Lake Valley, Washoe County, Nevada, through Bedell Flat to Lemmon and Spanish Springs Valleys, Washoe County, Nevada. The transported water would be used to support projected growth in those valleys. The gas pipeline would be used to provide fuel to pump the water out of Honey Lake Valley. This Draft EIS evaluates the direct, indirect and cumulative impacts of the proposed rights-of-way and the Winnemucca Valley, Red Rock Valley, Antelope Valley and no action alternatives.

Comments on this Draft EIS should be directed to: James M. Phillips, Lahontan Area Manager, U.S. Bureau of Land Management, 1535 Hot Springs Rd., Suite 300, Carson City, NV, 89706-0638. Ph. (702) 885-6000.

Date by which comments must be received: July 23, 1993



**Billy R. Templeton
Nevada State Director
U.S. Bureau of Land Management**

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SUMMARY

- *Project Description*

Washoe County, Nevada, proposes to obtain rights-of-way from the U.S. Bureau of Land Management (BLM) to cross public lands for a water pipeline and a natural gas pipeline. The water pipeline would cross 34 miles of public land and five miles of private land. It would begin at Fish Springs Ranch in Honey Lake Valley and end in Lemmon Valley north of Reno. The gas pipeline would originate at an existing natural gas pipeline near Wadsworth, Nevada. It would cross 33 miles of public land and 25 miles of private land and would end in Honey Lake Valley. The water and gas pipelines would occupy the same physical right-of-way for a distance of about 29 miles from northern Hungry Valley to Honey Lake Valley.

In March 1991, the State Engineer of Nevada approved Washoe County's export of 13,000 acre-ft/yr of groundwater from Honey Lake Valley. After various legal challenges, a Supplemental Ruling was issued by the State Engineer in October 1992 confirming the export of 13,000 acre-ft/yr of water. A motion to vacate that ruling was denied by the Second Judicial Court in Reno, Nevada, in February 1993.

The major federal action evaluated in this Environmental Impact Statement (EIS) is the granting of two rights-of-way to Washoe County, Nevada, for the use of certain public lands for a water pipeline and a gas pipeline. Because both the water and gas pipelines would pass through Bedell Flat, a major valley along the pipeline routes, this document is titled the *Bedell Flat Rights-of-Way EIS*. Granting the rights-of-way would allow Washoe County to proceed with their plans to construct the *Truckee Meadows Project* and supply future residents of Lemmon and Spanish Springs Valleys with groundwater from Honey Lake Valley. Rights-of-way across private lands for the pipelines, and the use of private lands for the pumping facilities in Honey Lake Valley, are not under the jurisdiction of the BLM. Use of these private lands would be subject to the approval of Washoe County and the affected private landowners. Operation of the pipelines would begin in 1995. Demand for the 13,000 acre-ft of water would be reached in 2015.

This EIS examines the *direct impacts* from construction of the water and gas pipelines. It also examines the *indirect impacts* of groundwater pumping in Honey Lake Valley and population growth in the Reno-Sparks metropolitan area. The *cumulative impacts* of developing the *Truckee Meadows Project* along with several alternative water supplies are also examined.

- *Alternatives*

Four alternatives to the proposed action are analyzed in this EIS. These include three alternative pipeline configurations and a no action alternative. The main differences among the various pipeline configurations are total length, miles of public land affected, and the environmental sensitivity of the lands along these alternative routes.

Under the no action alternative, the BLM would deny Washoe County's right-of-way applications. Washoe County and other water purveyors would continue to pursue other water-supply options for the community. Three sub-alternatives of the no action alternative that are evaluated in this EIS are:

- (1) A supply side sub-alternative consisting of 3,000 acre-ft/yr of groundwater from the Truckee Meadows and 6,900 acre-ft/yr of water from Truckee River irrigation rights;
- (2) A demand side sub-alternative, or conservation, which would reduce water demand by future residents; and
- (3) A negotiated settlement sub-alternative, which could make 39,000 acre-ft/yr available to the community by re-negotiating the operation of the reservoirs on the Truckee River.

- *Impacts*

Table S-1 summarizes and compares the direct and indirect environmental impacts from the proposed action and its alternatives.

Direct impacts to physical, biological, and cultural resources along the proposed route, the Antelope Valley alternative route, and the Winnemucca Valley alternative route would not be significant. Selection of the Red Rock Valley alternative route could cause significant impacts to wetlands and riparian areas in Red Rock Valley.

Granting the rights-of-way would result in *indirect impacts* in (1) Honey Lake Valley and surrounding areas from drawdown of the regional groundwater table, and (2) the Reno-Sparks metropolitan area from population growth supported by water from the *Truckee Meadows Project*. There would be no differences in the *indirect impacts* in Honey Lake Valley and in the Reno-Sparks metropolitan area from selection of the proposed Bedell Flat pipeline route or one of the three alternative pipeline routes.

The proposed action would accommodate some of the facilities that would provide water for growth in Lemmon and Spanish Springs Valleys through the year 2015. It would serve a total population of 46,500. It would help achieve one of the goals of the Truckee Meadows Regional Plan which is to direct future growth to Spanish Springs Valley, and it would help end the development moratorium in Lemmon Valley. On a cumulative basis, the proposed action would help to support water supplies for Washoe County through the year 2032 in combination with the negotiated settlement for operation of the Truckee River, other water supplies, and aggressive water conservation.

The proposed action is projected to have significant indirect adverse impacts to wetlands on private lands at Fish Springs Ranch because irrigation at the ranch would cease. It is projected to lower the groundwater table in eastern Honey Lake Valley and reduce the flow of groundwater to the Smoke Creek Desert. This could result in the loss of additional wetlands in Honey Lake Valley and in the Smoke Creek Desert. Groundwater-dependent vegetation would be reduced in parts of Honey Lake Valley. The proposed action could

adversely affect future plans by the Pyramid Lake Indian Tribe to develop irrigated farming in the southern Smoke Creek Desert. It has a slight potential to interfere with efforts by the Sierra Army Depot to remediate groundwater contamination.

The most important difference between the proposed action and the no action alternative is the lack of impacts in Honey Lake Valley under no action. Under no action, there would be no groundwater drawdown, no reduction in groundwater flow to Pyramid Lake and the Smoke Creek Desert, and no change to the vegetation communities in Honey Lake Valley.

The differences in indirect impacts in the Reno-Sparks metropolitan area among the proposed action and the no action alternative are related to population growth. Considerable disagreement exists as to whether water development projects merely permit growth to occur or whether they actually induce growth. While no area can grow without adequate water supplies, the availability of water alone does not guarantee that growth will occur. Population and economic growth are determined by a multitude of interrelated economic, social, and political factors.

Potential population growth would be lowest for the supply side sub-alternative and highest for the negotiated settlement sub-alternative. The *Truckee Meadows Project* and the negotiated settlement sub-alternative could support the same projected growth in Lemmon and Spanish Springs Valleys through 2015. The negotiated settlement sub-alternative would also support projected growth in the Truckee Meadows through 2015.

Because the demand side sub-alternative is based on reductions of future water demand through implementation of aggressive conservation measures for new construction, the water savings associated with this sub-alternative are dependent on the development of new water supplies.

If the no action alternative is selected, Washoe County would continue to pursue other water-management options. Control over the selection of these options is not within the authority of the BLM. The three options that are analyzed in this EIS are intended to provide information to decision makers, state and local agencies, and the people of Washoe County concerning the impacts of developing these options.

TABLE S-1

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND ITS ALTERNATIVES

Affected Resources	Bedell Flat Proposed Action	Winnemucca Valley Alternative	Antelope Valley Alternative	Red Rock Valley Alternative	No Action Alternative		
					Supply Side Sub-Alternative	Demand Side Sub-Alternative	Negotiated Settlement Sub-Alternative
WATER SUPPLY: (acre-ft/yr)	13,000	13,000	13,000	13,000	9,900	0	39,000
SOILS: (acres disturbed) ^(a)	9,840	9,830	9,860	10,080	4,300	0	16,300
AIR QUALITY:							
1. Carbon Monoxide (kg/day) ^(b)	2,580	2,580	2,580	2,580	2,620	0	10,700
2. Particulate Matter							
• Truckee Meadows Nonattainment Area (kg/day)	1,300	1,300	1,300	1,300	1,440	0	5,900
• Honey Lake Valley (μ g/m ³)	14.4	14.4	14.4	14.4	0	0	0
3. Ozone ^(c)							
• Hydrocarbons (kg/day)	1,600	1,600	1,600	1,600	850	0	3,410
• Nitrogen Oxides (kg/day)	2,260	2,600	2,600	2,600	1,240	0	4,880
SURFACE WATER:							
• Dry Washes Crossed by Pipelines	80	66	80	89	0	0	0
• Creek Segments Crossed by Pipelines	8	7	8	9	0	0	0
GROUNDWATER FLOW AND QUANTITY:							
1. Drawdown of Water Table (in feet): ^(d)							
• Honey Lake Valley along California Border ^(e)	20-25	20-25	20-25	20-25	0	0	0
• Astor Pass	50-55	50-55	50-55	50-55	0	0	0
• Sand Pass	35	35	35	35	0	0	0
• Sierra Army Depot	<5	<5	<5	<5	0	0	0
2. Groundwater Flow to Smoke Creek Desert from Honey Lake Valley (in acre-ft/yr)	3,040	3,040	3,040	3,040	5,300	5,300	5,300
GROUNDWATER QUALITY AT WELL FIELD: (in % change, in "+" or "-", from 1988 TDS values)	+15	+15	+15	+15	0	0	0

(Continued next page)

TABLE S-1

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND ITS ALTERNATIVES

(a)	Includes direct impacts along pipeline routes and indirect impacts in the Reno-Sparks metropolitan area.
(b)	For Truckee Meadows nonattainment area only.
(c)	Includes emissions in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows.
(d)	Maximum drawdown of the water table is projected by computer modeling to occur about 100 years after pumping begins.
(e)	This is the maximum predicted drawdown along the Nevada-California state line west of Fish Springs Ranch. Drawdown elsewhere along the border is projected to be less.
(f)	Maximum subsidence would take several hundred years to occur.
(g)	Includes the combined acreage of direct and indirect impacts along the pipeline routes and in the water source area.
(h)	Includes the combined acreage of direct and indirect impacts along the pipeline routes, in the water source area, and in the delivery/use area.
(i)	Includes costs for facilities and the acquisition of water rights; financing costs are not included.
(j)	The increase in vehicle miles travelled is a quality of life indicator of potential traffic congestion in the Reno-Sparks metropolitan area in 2015.

1.0 INTRODUCTION

1.1 BACKGROUND

Washoe County, Nevada, proposes to obtain rights-of-way across public lands for a water pipeline and a natural gas pipeline. The right-of-way for the water pipeline would be 34 miles long and would be used to accommodate portions of a 39-mile buried water pipeline from Honey Lake Valley, Nevada, through Bedell Flat, Nevada, to Lemmon Valley, Nevada (Figure 1-1). Five miles of the water pipeline would be located on private lands and are not part of the federal action for this Environmental Impact Statement (EIS). The proposed gas pipeline right-of-way would be 33 miles long and would be used to accommodate portions of a 58-mile buried gas pipeline from Wadsworth, Nevada, through Bedell Flat to Honey Lake Valley (Figure 1-1). Twenty-five miles of the gas pipeline would be located on private lands and are not part of the federal action for this EIS. The gas pipeline would supply the fuel to pump the water from Honey Lake Valley to Lemmon Valley. As shown on Figure 1-1, the water and gas pipelines would occupy the same physical right-of-way from northern Hungry Valley to Honey Lake Valley — a distance of about 30 miles.

The major federal action considered in this EIS is the granting of both right-of-way applications for use of public lands managed by the U.S. Bureau of Land Management (BLM). Because both rights-of-way would pass through Bedell Flat, a major valley along the pipeline routes (Figure 1-1), this document is titled the Bedell Flat Rights-of-Way EIS.

The proposed rights-of-way are one component of Washoe County's *Truckee Meadows Project* to import water to Lemmon and Spanish Springs Valleys from Honey Lake Valley. That project includes other rights-of-way across private lands, ancillary facilities, and an inter-basin transfer of water. The rights-of-way across public land are subject to federal approval. Rights-of-way across private land, and the use of private land for ancillary facilities, are subject to Washoe County approval and the approval of private landowners. The inter-basin transfer of water was approved by the State Engineer of Nevada in March 1991. After various legal challenges, a Supplemental Ruling was issued by the State Engineer in October 1992 confirming the export of 13,000 acre-ft/yr by Washoe County. A motion to vacate that ruling was denied by the Second Judicial Court in Reno, Nevada, in February 1993.

The direct, indirect, and cumulative environmental impacts of granting the rights-of-way across public land are evaluated in this EIS. The physical area affected *directly* by construction along the proposed pipeline routes is shown on Figure 1-1. Washoe County has applied for 100-foot-wide rights-of-way for both the water and gas pipelines. After construction, narrower rights-of-way would be used for access to, and maintenance of, the pipelines. Two water storage tanks are proposed on public land near the end of the water pipeline in Lemmon Valley (Figure 1-1). In addition, two segments of public land in Honey Lake Valley totalling 1.3 miles would be required for the water distribution pipes that connect the wells to the pumping station. This EIS evaluates the direct impacts of constructing and operating the pipelines on public land. Facilities in Honey Lake Valley, as well as water-distribution facilities in Lemmon and Spanish Springs Valleys, would be

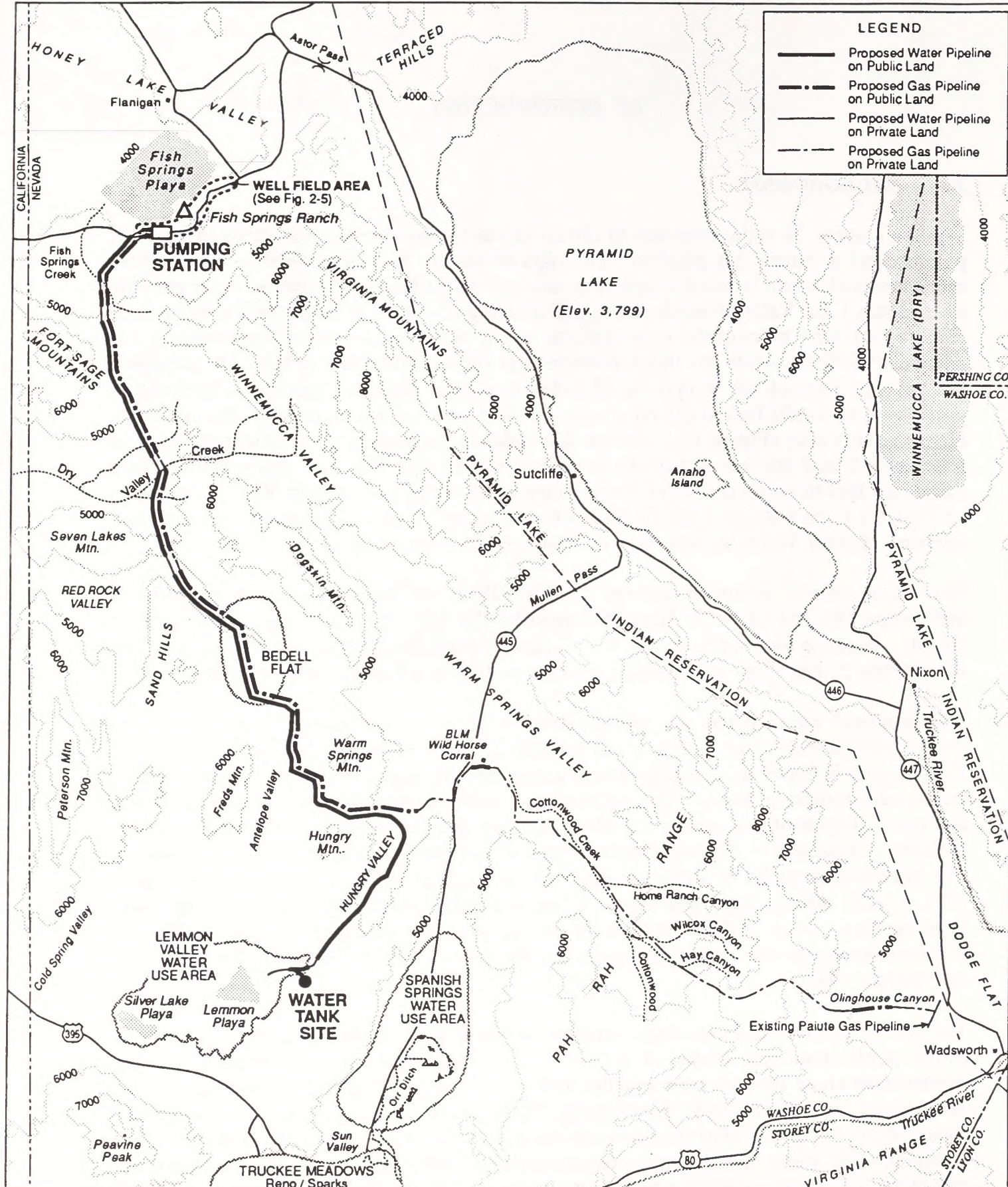
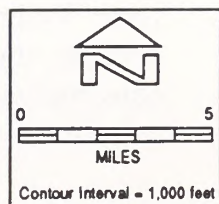


Figure 1-1
Proposed Bedell Flat Rights-of-Way



built on private land. These facilities are ancillary to those subject to the federal action for this EIS, which are the two rights-of-way across public land (Figure 1-1).

Washoe County's use of the rights-of-way could result in indirect impacts from drawdown of the groundwater table in Honey Lake Valley, as well as growth in Lemmon and Spanish Springs Valleys. The area *indirectly* affected by the rights-of-way is shown on Figure 1-2. This area was determined through an open public-scoping process and inter-agency consultation.

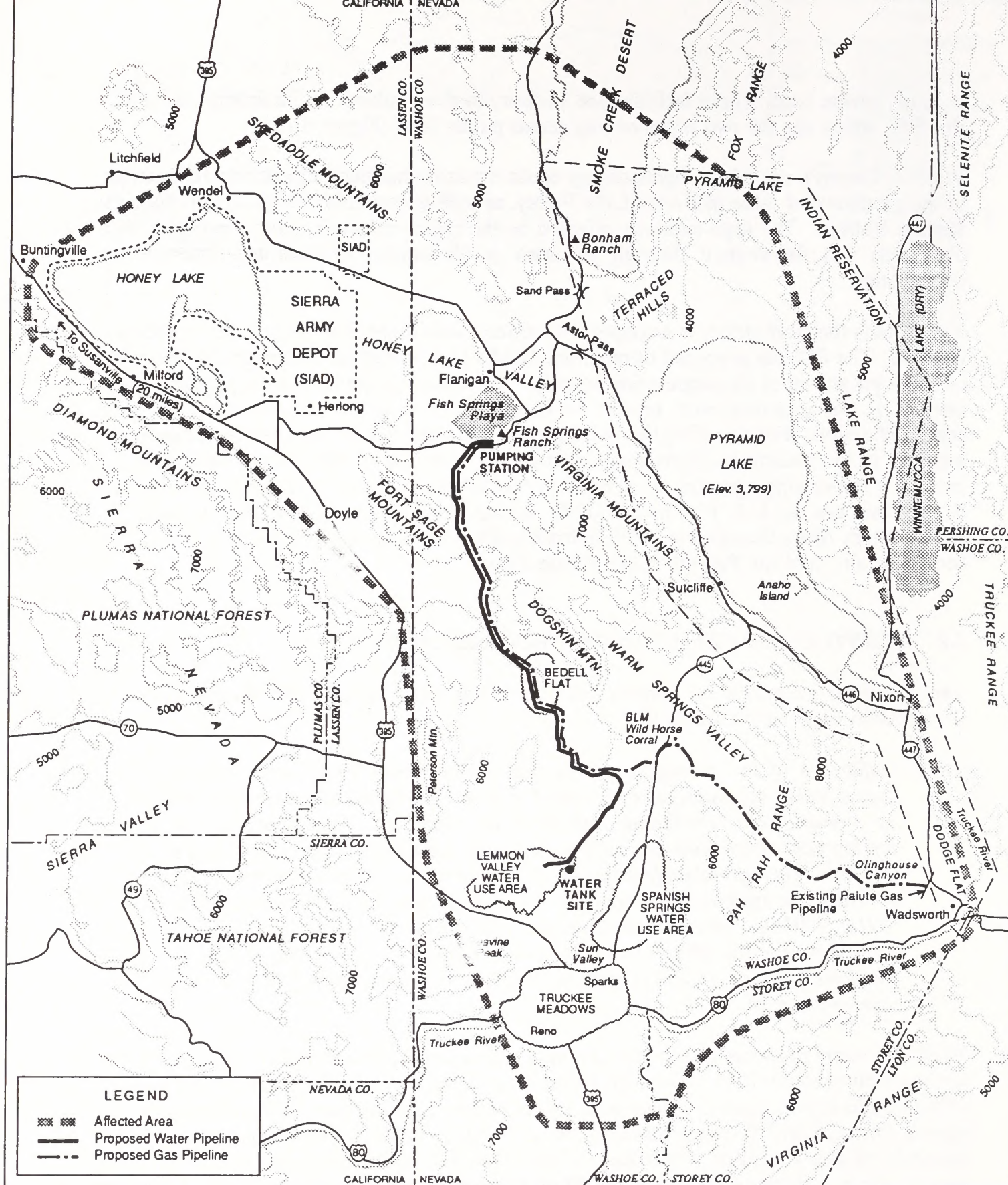
The BLM is the lead agency in a cooperative process with other federal agencies to prepare this EIS. The EIS was prepared through the BLM's District Office in Carson City, Nevada, with the assistance of six cooperating agencies. Cooperating agencies have jurisdiction by law or special expertise with respect to certain environmental impacts involved in a proposed action. For this EIS, the BLM used the environmental analyses of cooperating agencies to the maximum extent possible, consistent with the BLM's responsibility as lead agency. Cooperating agencies (as defined in 40 CFR Part 1501.6) that participated in the EIS process are the U.S. Fish and Wildlife Service, the U.S. Geological Survey, the U.S. Army (Sierra Army Depot), the U.S. Environmental Protection Agency, the U.S. Bureau of Indian Affairs, and the Pyramid Lake Paiute Tribe.

1.2 PURPOSE AND NEED FOR THE PROPOSED ACTION

The following statement of purpose and need was approved by the Washoe County Commission on November 24, 1992:

Fulfillment of the existing long-term plan for Lemmon Valley and Spanish Springs Valley continues to be hampered by a lack of confirmed water resources. As a result, local jurisdictions and the State Engineer's office have imposed development restrictions on each valley until additional water supplies are available. Yet regional projections identify Lemmon and Spanish Springs Valleys as centers for significant development through the year 2007 (Washoe County, 1991a; 1991b). To accommodate this planned development in a manner consistent with the goals of the Truckee Meadows Regional Plan (Truckee Meadows Regional Planning Agency, 1991), a reliable source of high-quality water is essential.

Washoe County proposes to provide Lemmon and Spanish Springs Valleys with water for development through 2015. Although formal population forecasts for these valleys extend only through 2007, land use designations in the master plan for each valley accommodate growth through 2015 (Washoe County, 1991a; 1991b). Table 1-1 shows the approximate schedule of water deliveries to these valleys. To accomplish this goal, the county has applied for two rights-of-way from the BLM for use of public lands (the federal actions requiring this EIS). The first right-of-way is for construction and operation of a 39-mile buried pipeline that would transport 13,000 acre-ft/yr of groundwater from the Honey Lake



Valley to Lemmon Valley. From Lemmon Valley, the water would be distributed via new pipelines to water users in Lemmon and Spanish Springs Valleys for municipal and industrial purposes.

The second right-of-way is for construction and operation of a 58-mile buried gas pipeline to power the pumps that would transport the water. The gas pipeline would originate near Wadsworth, Nevada, and end in Honey Lake Valley; it would be contiguous with the northern half of the water pipeline.

TABLE 1-1 PLANNED WATER DELIVERIES FROM THE TRUCKEE MEADOWS PROJECT			
Year	Lemmon Valley (acre-ft/yr)	Spanish Springs Valley (acre-ft/yr)	Total (acre-ft/yr)
1994	0	0	0
1995	30	300	330
2000	200	2,400	2,600
2005	400	5,800	6,200
2010	600	9,300	9,600
2015	800	12,200	13,000 ^(a)
^(a) Water deliveries would continue at this annual rate after 2015.			

The service area for the imported water would be limited to customers whose wastewater is not discharged into the Truckee River. Initially, the county would use existing wastewater treatment facilities in Lemmon Valley and septic systems in Spanish Springs Valley; new wastewater treatment facilities would be required as each valley develops.

1.3 RELATIONSHIP TO BLM POLICIES, PLANS, AND PROGRAMS

BLM policies, plans, and programs for rights-of-way in the affected area are outlined in the Lahontan Resource Management Plan (RMP; BLM, 1984). Rights-of-way corridors were identified to minimize environmental impacts from major overhead powerlines, especially visual impacts. The RMP does not restrict rights-of-way for underground pipelines to designated corridors.

The BLM requires that rights-of-way be subject to environmental analysis and compliance with federal and state law. This is accomplished through consultation with local government agencies, landowners next to and affected by the rights-of-way, federal and state agencies, and the public. The BLM requires that rights-of-way be limited to the ground necessary for operation and maintenance of the facilities, as well as protection of public safety and the avoidance of unnecessary damage to the environment. The BLM also requires that rights-of-way contain terms and conditions to minimize damage to scenic and aesthetic values and fish and wildlife habitat, and to otherwise protect the environment and to assure compliance with applicable air and water quality standards.

The BLM has designated Bedell Flat and Dry Valley for roaded, general recreational opportunities. Rights-of-way are permitted in these valleys providing that they do not alter the present undeveloped character of the valleys.

The proposed rights-of-way are in conformance with the Lahontan Resource Management Plan. Although they would not be located within designated right-of-way corridors, they involve primarily buried facilities with limited visual intrusions.

1.4 RELATIONSHIP TO NON-BLM POLICIES, PLANS, AND PROGRAMS

1.4.1 Federal

Negotiations pursuant to Public Law 101-618 (the Truckee-Carson-Pyramid Lake Water Rights Settlement Act of 1990; commonly known as the *Negotiated Settlement Act*) are currently under way. The *Negotiated Settlement Act* is based on a *Preliminary Settlement Agreement* entered into on May 23, 1989, between the Pyramid Lake Paiute Tribe and the Sierra Pacific Power Company. The Act proposes, among other things, to resolve a host of legal and environmental issues on the allocation and use of Truckee River water. Completion of the *Truckee Meadows Project*, and successful negotiations under the *Negotiated Settlement Act*, could each result in large increases in the supply of water for the Reno-Sparks metropolitan area (includes the valleys north of Reno-Sparks). If both water supplies become available to the community, their place of use would be managed by prior terms, conditions, and agreements.

Successful completion of negotiations under the *Negotiated Settlement Act* is supported by Washoe County and the U.S. Department of the Interior. This law allocates the waters of the Truckee and Carson Rivers between California and Nevada (Section 204). Section 205 requires the Secretary of the Interior to negotiate an Operating Agreement with the States of Nevada and California for operation of the reservoirs on the Truckee River. An EIS on this Agreement is currently being prepared by the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service; completion is expected in the mid-1990s. The Operating Agreement would ensure that the reservoirs on the Truckee River would be operated to:

- satisfy all applicable dam safety and flood control requirements;
- provide for the enhancement of spawning flows available in the Lower Truckee River for the Pyramid Lake Fishery in a manner consistent with the Secretary's responsibilities under the Endangered Species Act, as amended;
- carry out the terms, conditions, and contingencies of the Preliminary Settlement Agreements as modified by the Ratification Agreement. Mitigation necessary to reduce or avoid significant adverse environmental effects, if any, of the implementation of the Preliminary Settlement Agreement as modified by the Ratification Agreement, including in-stream beneficial uses of water within the Truckee River basin, shall be provided through one or more "mitigation agreements."
- ensure that water is stored in and released from Truckee River reservoirs to satisfy the exercise of water rights in conformance with the *Orr Ditch Decree* and *Truckee River General Electric Decree*, except for those rights that are voluntarily relinquished by the parties to the Preliminary Settlement Agreement as modified by the

Ratification Agreement, or by any other persons or entities, or which are transferred pursuant to State law; and

- minimize the Secretary's costs associated with operation and maintenance of Stampede Reservoir.

In addition, the Operating Agreement may include, but is not limited to, provisions concerning the following subjects:

- administration of the operating agreement, including but not limited to establishing or designating an agency or court to oversee operation of the Truckee River and Truckee River reservoirs;
- means of assuring compliance with the provisions of the Preliminary Settlement Agreement as modified by the Ratification Agreement and the Operating Agreement.
- operations of the Truckee River system which will not be changed;
- operations and procedures for use of Federal facilities for the purpose of meeting the Secretary's responsibilities under the Endangered Species Act, as amended;
- methods to diminish the likelihood of Lake Tahoe dropping below its natural rim and to improve the efficient use of Lake Tahoe water under extreme drought conditions;
- procedures for management and operations at the Truckee River reservoirs;
- procedures for operation of the Truckee River reservoir for in-stream beneficial uses of water within the Truckee River basin;
- operation of other reservoirs in the Truckee River basin to the extent that owners of affected storage rights become parties to the Operating Agreement; and;
- procedures and criteria for implementing California's allocation of Truckee River water.

The Secretary of the Interior has a federal trust responsibility with respect to lands and resources of the Pyramid Lake Tribe held in trust by the United States.

1.4.2 State and Local

Approval of Washoe County's inter-basin transfer of water falls under the jurisdiction of the State of Nevada. Approval was initially granted by the State Engineer on March 1, 1991. It was subsequently reversed and remanded by the Second Judicial Court in Reno on August 31, 1992, based on appeals by Lassen County, California, and the Pyramid Lake Paiute Tribe. In October 1992, after consideration of the Court's decision, the State Engineer

issued a Supplemental Ruling that again approved the inter-basin transfer of 13,000 acre-ft/yr of water. A motion to vacate that ruling was denied by the Second Judicial Court in Reno, Nevada, in February 1993.

Washoe County currently has applications before the State Engineer for additional supplies of groundwater from Honey Lake Valley. These applications are being held in abeyance pending the results of further hydrological studies. In his ruling (as amended), the State Engineer also required that Washoe County submit a monitoring plan, install well meters, and ensure that no violations occur to any water quality standards.

The States of Nevada and California are participants in negotiations under the *Negotiated Settlement Act* (see description in Section 1.4.1).

Senate Bill 367 (Nevada) created a regional planning process for southern Washoe County to help resolve issues from a regional standpoint. Under this statute, the Truckee Meadows Regional Plan was developed as the unifying framework for development in Reno, Sparks, and much of southern Washoe County (Truckee Meadows Regional Planning Agency, 1991). As part of this regional planning process, Washoe County was designated as the Regional Water Resource Management Agency in 1993, with responsibilities to plan and manage various water-related projects for the community. The *purpose and need* for the proposed action (Section 1.2) states that Washoe County plans to provide Lemmon and Spanish Springs Valleys with water to accommodate growth as forecasted in the *Truckee Meadows Regional Plan*.

Between 1989 and 1991, Reno, Sparks, and Washoe County entered into a regional-planning process. They agreed to abide by the decision of an impartial fact-finder on water related issues. On October 4, 1990, the fact-finder recommended a coordinated approach to wastewater treatment, water supply, flood control, and storm drainage (Warren, 1990). The fact-finder also recommended that Washoe County be assigned the duty of managing these functions throughout the area. Under the terms of the agreement, Reno and Sparks will transfer their wastewater facilities to Washoe County in 1993.

Final implementation of the county's role as Regional Water Resources Management Agency will occur at the completion of the *Coordinated Regional Water Supply and Quality Study* and its adoption by the Washoe County Commission. The study is designed to determine the optimum program of improvements and management actions for the area's water supplies, municipal wastewater treatment, flood control, and storm-drainage needs, as well as improve the water quality of the Truckee River through the year 2012. The *Truckee Meadows Project* is one of the water supply alternatives included in the *Coordinated Regional Water Supply and Quality Study*. After completion of the study, the Washoe County Commission will select a course of action and then develop a Capital Improvement Program, which will be submitted to the Regional Planning Governing Board, and an operating plan.

1.5 AUTHORIZING ACTIONS

This EIS has been prepared pursuant to the National Environmental Policy Act (NEPA) and the Council on Environmental Quality's regulations for implementing NEPA. The BLM has incorporated the environmental protection goals of NEPA into its ongoing programs and activities through its NEPA Handbook.

On March 1, 1991, the State Engineer of Nevada approved the export of 13,000 acre-ft/yr of groundwater from Honey Lake Valley by Washoe County. This approval was subsequently reversed and remanded by the Second Judicial Court in Reno on August 31, 1992, based on appeals by Lassen County, California, and the Pyramid Lake Paiute Tribe. In October 1992, after consideration of the Court's decision, the State Engineer issued a Supplemental Ruling that again approved the inter-basin transfer of 13,000 acre-ft/yr of water. A motion to vacate that ruling was denied by the Second Judicial Court in Reno, Nevada, in February 1993.

BLM authorizing actions for the rights-of-way would occur under separate authorities for the water and gas pipelines. The Secretary of the Interior is authorized by the Federal Land Policy and Management Act of 1976 to grant rights-of-way across federal lands for water pipelines and storage facilities. Under the Act, BLM requires that right-of-way boundaries be limited to the ground necessary to operate and maintain the facilities, provide for public safety, and cause no unnecessary damage to the environment. These determinations will be made through this EIS. If a right-of-way for the water pipeline and storage facilities in Lemmon Valley is approved, a grant would be issued subject to terms and conditions to carry out the purposes of the Federal Land Policy and Management Act. These terms and conditions include measures to minimize damage to scenic values, wildlife habitat, and to other environmental values; to locate facilities along a route that would cause the least damage to the environment, taking feasibility into account; and to otherwise protect the public interest in the lands traversed by the right-of-way and adjacent lands.

For natural-gas pipelines, the Secretary of the Interior is authorized to grant rights-of-way across federal lands under the Mineral Leasing Act of 1920, as amended. That act limits the width of rights-of-way to 50 feet plus the ground occupied by the pipeline, unless a wider right-of-way is needed to protect the environment or the public. The Secretary is authorized to require measures to restore and revegetate right-of-way disturbances, control undue surface erosion, control or prevent damage to the environment, and protect public safety. Because the proposed gas pipeline would traverse steep terrain, the width of the construction right-of-way requested by Washoe County is 100 feet. This width would reduce the risk of injury to construction crews and the public. After construction of the gas pipeline, the right-of-way would be reduced to a width required for normal operation and maintenance (50 feet or less). A 15-foot-wide dirt road for maintenance of and access to the pipelines would also be required.

Table 1-2 summarizes the major authorizing actions for construction and operation of the pipelines. Final decisions on the need for any of the permits or approvals listed on Table 1-2 would be determined through consultations with the responsible regulatory agencies.

TABLE 1-2**REGULATORY REQUIREMENTS FOR THE BEDELL FLAT RIGHTS-OF-WAY**

Permit/Approval/Requirement	Lead Regulatory Agency
1. Environmental Impact Statement (this document)	1. U.S. Bureau of Land Management
2. Clearances pursuant to the National Historic Preservation Act (and related Acts) ^(a)	2. Nevada State Historic Preservation Office
3. Clearances pursuant to the Endangered Species Act ^(a)	3. U.S. Fish and Wildlife Service
4. Coordination concerning prime and unique Farmland pursuant to the Farmland Protection Policy Act ^(a)	4. U.S. Soil Conservation Service
5. Permits to construct and operate certain equipment, pursuant to the Clean Air Act, and development of a dust control plan.	5. Nevada Department of Conservation and Natural Resources
6. Compliance with the Migratory Bird Treaty Act	6. U.S. Fish and Wildlife Service
7. Compliance with the Comprehensive Environmental Response, Compensation, and Liability Act	7. Nevada Department of Conservation and Natural Resources
8. Compliance with the Toxic Substances Control Act	8. Nevada Department of Conservation and Natural Resources
9. Permit to encroach onto a State Roadway	9. Nevada Department of Transportation
10. Consultation with affected tribes pursuant to the American Indian Religious Freedom Act ^(a) and Native American Graves Protection and Repatriation Act	10. U.S. Bureau of Land Management
11. Free-Use Permit pursuant to the Materials Act	11. U.S. Bureau of Land Management
12. Compliance with Section 404 of the Clean Water Act (Nationwide permit for stream/drainage crossings) and Nevada 401 water quality certification	12. U.S. Army Corps of Engineers and Nevada Department of Conservation and Natural Resources
13. Submittal of a Plan of Development	13. U.S. Bureau of Land Management

^(a) Compliance with this Act is part of the EIS for the Bedell Flat Rights-of-Way (item #1).

1.6 PUBLIC PARTICIPATION

The BLM has encouraged public comment throughout the preparation of this EIS. On June 18, 1990, the BLM issued a Notice of Intent to prepare an environmental document on the proposed rights-of-way. Based on the 149 letters received, the BLM decided that an EIS should be prepared.

On July 24, 1990, the BLM issued a Notice of Intent in the Federal Register and in local newspapers throughout the affected region that an EIS would be prepared on the proposed

rights-of-way. Since that time, the BLM has received almost 60 additional letters on the suggested scope of the EIS.

Scoping issues were also identified from (1) records of public meetings in Reno by the *Citizen's Advisory Board to the Truckee Meadows Project* held between February 1989 and October 1990; (2) records and subsequent correspondence of a public hearing held in Reno on July 6, 1989, before the Washoe County Board of Adjustment concerning the proposed issuance of a Special Use Permit to Washoe County for construction of the *Truckee Meadows Project* [the Special Use Permit was issued July 25, 1989, by the Washoe County Commission]; (3) records of hearings in Sacramento, California, on October 25, 1989, by the *Senate Select Committee on the Sierra/Cascade/Klamath Watersheds* on the use and export of water from interstate groundwater basins in northeast California; and (4) transcripts of the September 14, 1990, *Public Comment Session* of the Nevada State Engineer's hearings in Sparks on Washoe County's applications to transfer groundwater from Honey Lake Valley.

Based on the concerns raised during scoping, issues and alternatives to be examined in the EIS were identified. Table 5-1 in Section 5.0 summarizes these issues.

In August 1991, and again in February 1992, newsletters were mailed to all interested and affected parties. Both newsletters emphasized that scoping is an on-going process and that the BLM encourages and welcomes comments throughout the EIS process. The first newsletter described the proposed rights-of-way, the issues to be examined in the EIS, and a tentative schedule for release of the Draft EIS to the public. It also identified the people responsible for preparing the EIS and described the role of each cooperating agency. The second newsletter described the status of the EIS, changes in the schedule, and alternative routes for the pipelines.

The BLM has ensured a comprehensive approach to this EIS by seeking out and inviting the participation of other federal agencies and Indian tribes as cooperating agencies. The BLM signed agreements with the U.S. Environmental Protection Agency, the U.S. Bureau of Indian Affairs, the U.S. Fish and Wildlife Service, the U.S. Army, the U.S. Geological Survey, and the Pyramid Lake Paiute Tribe. Each of the agencies has jurisdiction by law or special expertise for particular sections of this document.

The BLM has invited comments from the cooperating agencies throughout the preparation of the Draft EIS, conducted interagency meetings, met with individual cooperating agencies, and provided formal review and comment periods on early drafts of Chapters 1 and 2 and on a Preliminary Draft EIS. Each agency's comments and environmental analyses were used to the maximum extent feasible, consistent with BLM's role as the lead agency.

1.7 PROTEST PROCEDURES

The BLM provides the public with the opportunity to appeal decisions made by the BLM which affect public land. Appeals, however, can be filed only after a final land-use decision is made. Because this document is a Draft EIS only, and does not include a decision, no appeals are appropriate at this time. Anyone wishing to challenge in court an action on the rights-of-way will be limited to those issues raised in written correspondence submitted to the BLM or raised at public hearings. Within 30 days after issuance of the final Record of Decision on the rights-of-way applications, interested parties can appeal the decision to the Board of Land Appeals, Office of the Secretary, in accordance with the regulations at 43 CFR 4.400. The appellant has the burden of proof by positive and substantial evidence that the BLM's decision is in error.

2.0 THE PROPOSED ACTION AND ITS ALTERNATIVES

2.1 THE PROPOSED ACTION

2.1.1 Overview

Washoe County, Nevada, has applied to the BLM for a right-of-way to construct and operate a buried water pipeline on public lands between Honey Lake Valley, Nevada, and Lemmon Valley, Nevada, via Bedell Flat (Figure 1-1). Under authority of the Federal Land Policy and Management Act (Public Law 94-579), and pursuant to regulations under 43 CFR 2800, the BLM is authorized to grant a right-of-way for a water pipeline.

Washoe County has also applied to the BLM for a right-of-way to construct and operate a buried natural-gas pipeline on public lands between Wadsworth, Nevada, and Honey Lake Valley, via Bedell Flat. The natural gas would be used to power the turbines that would supply electrical power to the pumping station, wells, and related facilities in Honey Lake Valley. Under authority of Section 28 of the Mineral Leasing Act of 1920, as amended, and pursuant to regulations under 43 CFR 2800, the BLM is authorized to grant a right-of-way for a natural-gas pipeline.

Figure 1-1 shows the route of the proposed water and gas pipelines. The *major federal action* being considered in this EIS is the approval by the BLM of both right-of-way applications submitted by Washoe County for use of these public lands.

The water pipeline would be 39 miles long, 36 inches in diameter, and buried to a depth of three feet. Construction would require a right-of-way width of 100 feet. After construction, the right-of-way would be reduced to a width necessary for pipeline access and maintenance (perhaps 50 feet or less). Two water-storage tanks near the end of the pipeline in Lemmon Valley would be constructed on public land (Figure 1-1). In addition, a buried water-collection pipeline system would be constructed at and near Fish Springs Ranch in Honey Lake Valley to connect the water-supply wells to the pumping station.

The gas pipeline would be 58 miles long, six inches in diameter, and buried to a depth of three feet. Approximately 29 miles of the gas pipeline would be constructed along a route that is separate from the water pipeline (Figure 1-1). A construction width of 100 feet would be required along this 29-mile segment because of the steep terrain. The gas pipeline would join the route of the water pipeline in northern Hungry Valley (Figure 1-1). Where the gas and water pipelines are contiguous, a total right-of-way width of 100 feet would be sufficient for construction of both pipelines. After construction, the right-of-way would be reduced to a width necessary for pipeline access and maintenance (perhaps 50 feet or less).

Approximately 502 acres of public land would be disturbed for construction of the water and gas pipelines, the storage tanks, and the water-collection pipeline system in Honey Lake Valley. Most of the disturbed acreage would be reclaimed after construction, except for 15-foot-wide maintenance and access roads and other permanent structures associated with the pipelines.

The time required to procure materials and to construct the pipelines is estimated by Washoe County to be 13 to 16 months. Actual construction would take approximately nine months. The projected rate of groundwater pumping through the year 2015 is listed on Table 1-1. The precise schedule of pumping, however, depends on future water demand in Lemmon and Spanish Springs Valleys.

The proposed action is a part of Washoe County's plan to import groundwater from Honey Lake Valley for use in Lemmon and Spanish Springs Valleys. Known as the *Truckee Meadows Project*, the plan also includes the inter-basin transfer of water from Honey Lake Valley, operation of a well field at Fish Springs Ranch, and delivery facilities in Lemmon and Spanish Springs Valleys. In addition, parts of the pipeline routes, as well as the pumping facilities in Honey Lake Valley, would require the use of private lands. Use of these private lands is subject to the approval of each private landowner and by Washoe County. The BLM has no authority to control the use of private lands. This EIS evaluates the direct environmental impacts from construction and operation of the pipelines, as well as the indirect and cumulative environmental impacts that could result from granting the rights-of-way.

2.1.2 Proposed Rights-of-Way

The routes of the proposed water and gas pipelines are illustrated in Figure 2-1. Table 2-1 summarizes the acreage of land that would be disturbed during pipeline construction.

2.1.2.1 Water Pipeline

From the pumping station in Honey Lake Valley, the pipeline would rise approximately 1,500 feet to a 5,500-foot summit between the Fort Sage and Virginia Mountains. From the summit, the pipeline would descend into Dry Valley where it would cross several branches of Dry Valley Creek. After passing southward through Dry Valley, the pipeline would cross a low pass and descend along the west side of Bedell Flat where it would follow an existing road. It would exit Bedell Flat through a low pass that leads into the northern end of Antelope Valley. From northern Antelope Valley, the pipeline would trend southeasterly through a pass between Warm Springs Mountain and Hungry Mountain and enter Hungry Valley. The pipeline would traverse the length of Hungry Valley and terminate in Lemmon Valley at the intersection of Lemmon Valley Drive and Chickadee Drive.

The water pipeline would cross 34 miles of public land along its 39-mile path; the remaining five miles of pipeline would cross private land. Washoe County's right-of-way applications, if approved, would authorize only the use of public lands. Use of intervening private lands for pipeline construction would be negotiated between Washoe County and each affected private landowner.

Construction of the water pipeline would require space for trench excavation and backfill, pipe storage, and equipment operations (Figure 2-2). In some areas, pipe would be unloaded from trucks directly into the trench. In other areas, pipe would be strung along

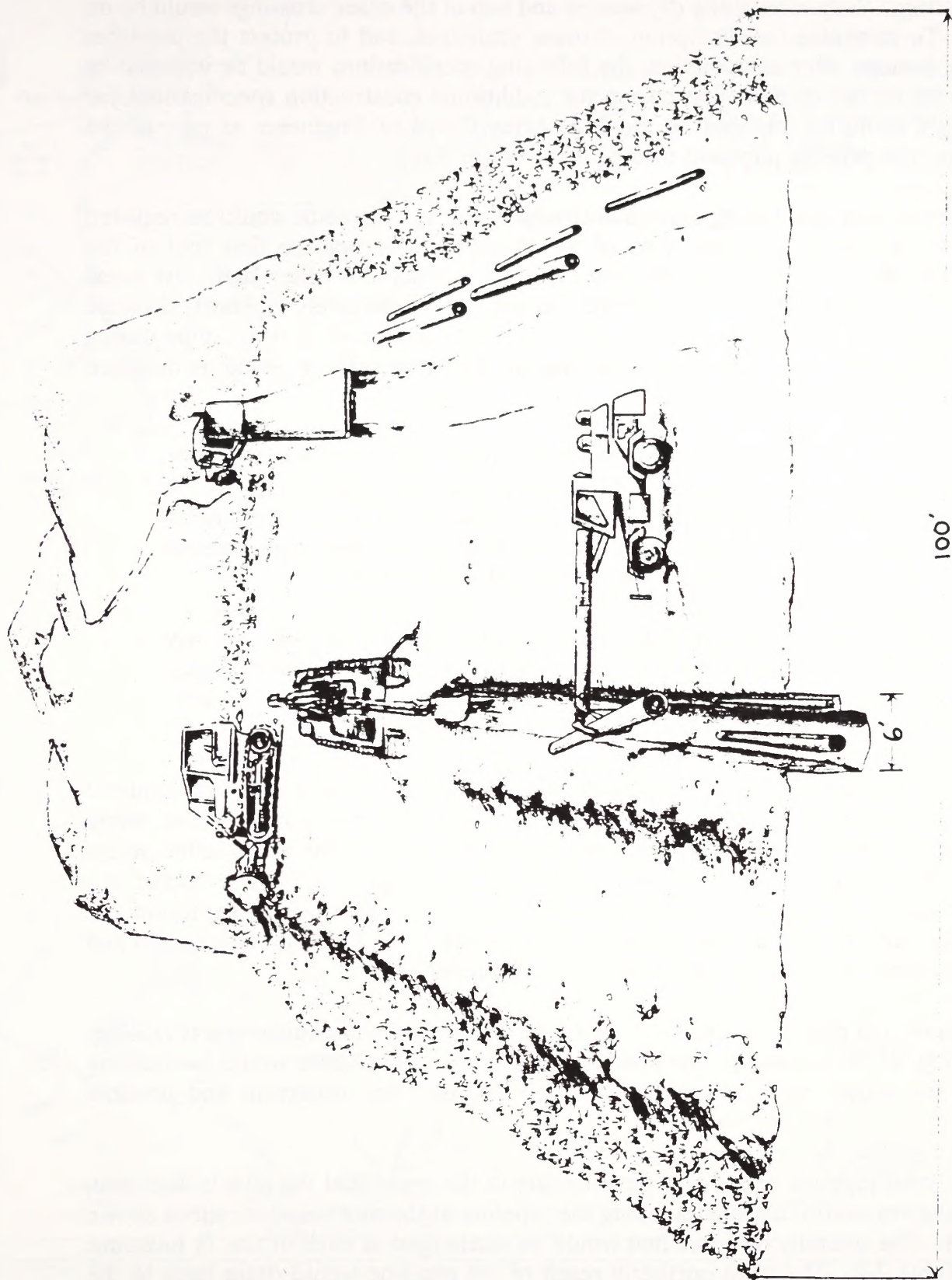


Figure 2-2

Oblique View of Typical Construction Zone Along Pipeline Right-of-Way

The water and gas pipelines would cross 80 dry washes and eight creeks, for a total of 88 drainage crossings. Sixty-nine of the dry washes and two of the creek crossings would be on public land. To minimize the disruption of these drainages, and to protect the pipelines from erosion damage after construction, the following specifications would be imposed by Washoe County on the construction contractor (additional construction specifications for these drainages could be imposed by the U.S. Army Corps of Engineers as part of the Section 404 permit process pursuant to the Clean Water Act):

- At the two locations having perennial stream flow, the contractor would be required to divert the stream to one side of the channel, construct the first half of the crossing, and then re-divert the stream and construct the other half. At some locations, a subsurface rock barrier would be constructed a short distance downstream of the pipeline to prevent erosion and undermining of the pipe during periods of high water flow (to prevent headward erosion). Rock would be obtained from previous trench excavations.
- In drainages with no stream flow, but where near-surface groundwater occurs, the contractor would be required to install a temporary culvert across the trench that would transport subsurface flow away from the trench. After installation of the pipe, the contractor would install permanent piping across the water pipeline to maintain near-surface groundwater flow.
- In dry washes where stream flow occurs only during brief periods of heavy thunderstorms or from melting of unusually heavy snowpack, the drainage would be restored to near-original conditions, but no other improvements would be made.

After construction of the pipelines is complete, a 15-foot-wide dirt road would be required for access to the pipelines, pipeline accessories (valves, etc.), and maintenance areas. Some existing roads near the rights-of-way would be used by Washoe County for pipeline access and maintenance. Where feasible, roads within the right-of-way would be constructed in a "dog-leg" configuration to avoid visually-intrusive straight-line views after vegetation has been re-established. All ditches and culverts along existing roads would be maintained and any structures damaged during construction would be repaired.

During operation, the pipeline route would be toured monthly, during which time corrosion-control readings would be taken. The only other expected maintenance would be draining segments of the water pipeline once every 10 to 15 years for inspection and possible cleaning.

Draining the water pipeline would also be necessary in the event that the pipe is damaged. Eleven drain valves would be installed along the pipeline at the numbered locations shown on Figure 2-1. The quantity of water that would be discharged at each of the 11 locations is listed on Table 2-2. The most northerly reach of the pipeline would drain back to the pumping station in Honey Lake Valley. The most southerly reach of the pipeline would drain to either the water-storage tanks in Lemmon Valley or to the overflow and drainage system that would be connected to the playa in Lemmon Valley (described in Section

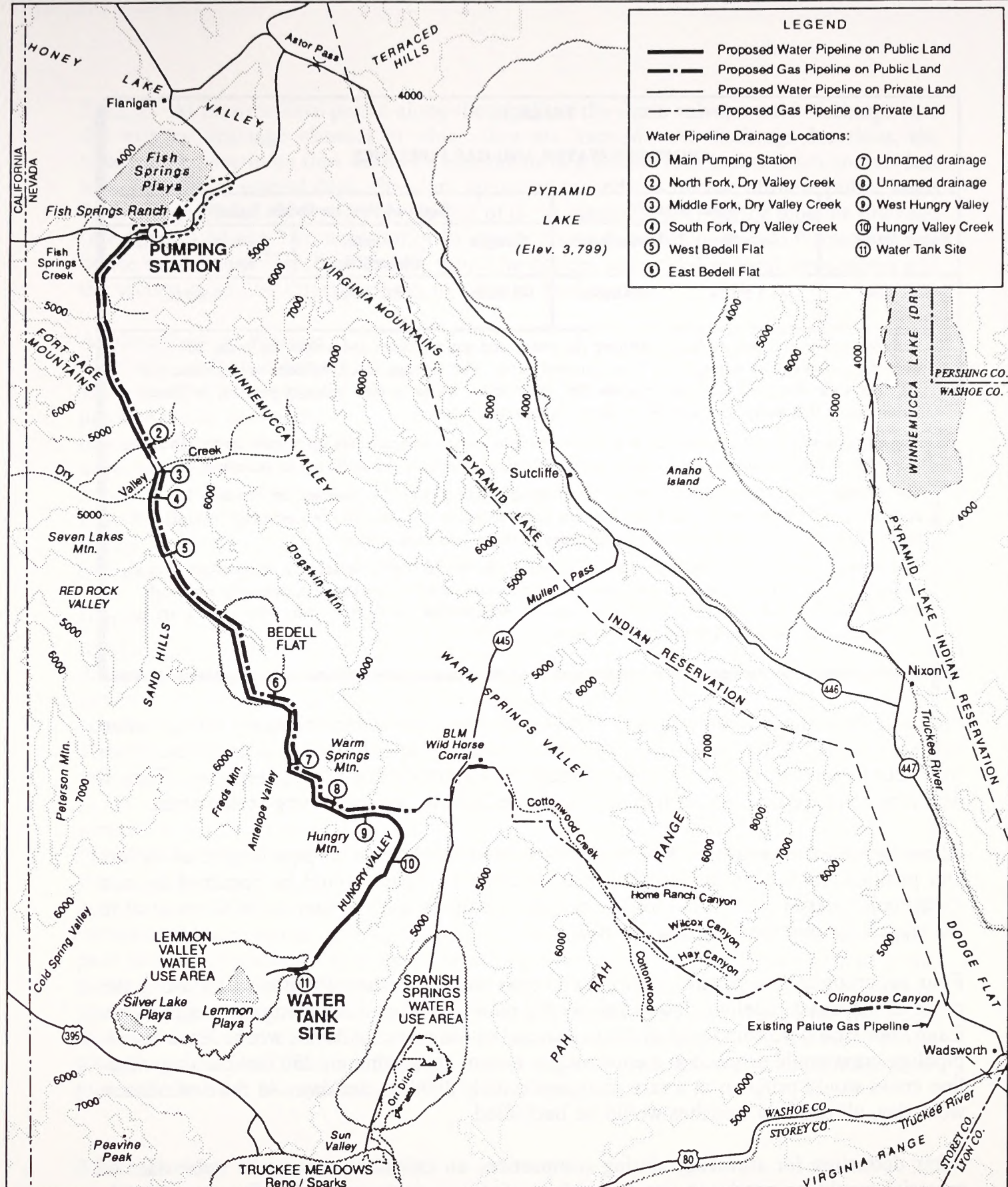


Figure 2-1

Major Components of the Bedell Flat Rights-of-Way

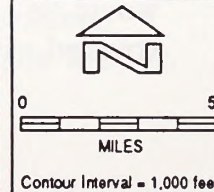


TABLE 2-1

PROPOSED WATER AND GAS PIPELINES

Route Name	Total Route ^(a)		Right-of-Way on Public Land ^(b)		
	Length	Disturbance	Length	Land Disturbance ^(c)	Disturbance After Reclamation ^(d)
Bedell Flat	77.5 miles	940 acres	41 miles	502 acres	75 acres

- ^(a) Includes public and private lands. Where the water and gas pipelines are within the same 100-foot-wide right-of-way, the mileage has been counted once. The acreage listed includes areas within the 100-foot-wide disturbed area where some dirt roads exist. Includes nine miles of pipeline in Honey Lake Valley that would connect the wells to the pumping station.
- ^(b) The right-of-way is not continuous; it is separated into numerous segments by private lands. Includes 1.3 miles of public land in Honey Lake Valley that would connect the wells to the pumping station.
- ^(c) The acreage listed includes areas within the proposed right-of-way that contain dirt roads approximately 15-foot wide. Also, the acreage listed includes an additional five acres for use of, and access to, the site for the terminal water-storage tanks in Lemmon Valley.
- ^(d) The acreage listed is the maximum number of acres that would not be reclaimed. It assumes that a 15-foot-wide access and maintenance road would be constructed within the 100-foot-wide rights-of-way. Actually, Washoe County would only require roads within the rights-of-way where there are no nearby existing roads outside the rights-of-way.

the route in advance of pipe laying. Heavy equipment would require space for operation and for turning. A 100-foot-wide construction zone is proposed for these activities. Prior to pipeline construction, all vegetation would be removed from the right-of-way. Topsoil would be stripped and, where feasible, stockpiled nearby for use during reclamation.

After the trench is excavated by a backhoe, a crane would pick up pipe lengths of 40 feet and position them over the trench for emplacement. Space would be required to load excavated material onto trucks for use at other locations, and to place suitable material in the trench for pipe bedding and backfill.

Four geographically separate construction crews would operate simultaneously along the route of the water pipeline. Two construction crews would operate along the gas pipeline. Each crew would be composed of 25 people and would work six days a week. Each water-pipeline crew would proceed at a construction rate of approximately 250 feet per day. Gas-line crews would progress at a rate of approximately 750 feet per day. At the end of each work day, all exposed trenches would be backfilled.

After deducting for shrinkage during compaction, an excess of about four cubic feet of material would be produced per linear foot of water-pipeline trench. Excess materials would be spread over the disturbed area after pipeline construction and, where available, covered with stockpiled topsoil.

2.1.2.2). At intermediate points along the pipeline, the drain valves would discharge into the existing drainage channel in which they are located. At discharge locations, the maximum downstream flow would be equivalent to a stream four inches deep and six feet wide flowing for several days. Standard operating procedures for use of these public lands further require that no erosion or scouring of these channels occur during pipeline drainage (see Section 2.1.6). Two weeks prior to any such scheduled drainage, two forms of public notice would be provided. The first would be notices advertised in local newspapers and the second would be direct mailings to affected land owners.

As described in Washoe County's right-of-way application, the water pipeline would eventually transport up to 13,000 acre-feet of water annually from Honey Lake Valley to Lemmon Valley for distribution to customers in Lemmon and Spanish Springs Valleys. Pumped at a constant rate, a 36-inch-diameter pipeline is capable of transporting almost 26,000 acre-ft/yr. The reason for selecting this diameter pipeline is so it can meet peak summer demands. These summer water demands are roughly three times

higher than winter demands. A smaller-diameter pipeline could be used, but the transported water would have to be stored somewhere in the delivery area to meet these peak summer demands. The costs for providing this storage, either at a tank farm or at the surface, are prohibitive. Moreover, the fuel costs to pump water through a small-diameter pipe are higher than the costs associated with a large-diameter pipe due to the increased frictional resistance of flowing water in the smaller-diameter pipe. On the basis of the foregoing constraints, Washoe County's project engineers decided that a 36-inch-diameter pipe was the most economical size for the water pipeline.

2.1.2.2 Terminal Water-Storage Tanks

Two water-storage tanks would be constructed on public land on the east side of Lemmon Valley, off Chickadee Drive (Figures 2-1 and 2-3). Access to and use of this site are included in Washoe County's right-of-way application for the water pipeline.

TABLE 2-2		
ESTIMATED WATER DISCHARGES FROM PIPELINE DRAINAGE VALVES		
Valve Location ^(a)	Pipeline Segment (feet)	Quantity of Discharge (acre-feet)
1. Main Pumping Station	24,700	29
2. North Fork, Dry Valley Creek	24,900	29
3. Middle Fork, Dry Valley Creek	9,100	10
4. South Fork, Dry Valley Creek	11,300	13
5. West Bedell Flat	40,300	47
6. East Bedell Flat	11,700	14
7. Unnamed draw	3,200	16
8. Unnamed draw	3,500	4
9. West Hungry Valley	15,800	19
10. Hungry Valley Creek	30,000	35
11. Water-Storage Tank Site	9,900	12
^(a) See Figure 2-1 for the location of valves along the water pipeline.		
Source: Washoe County		

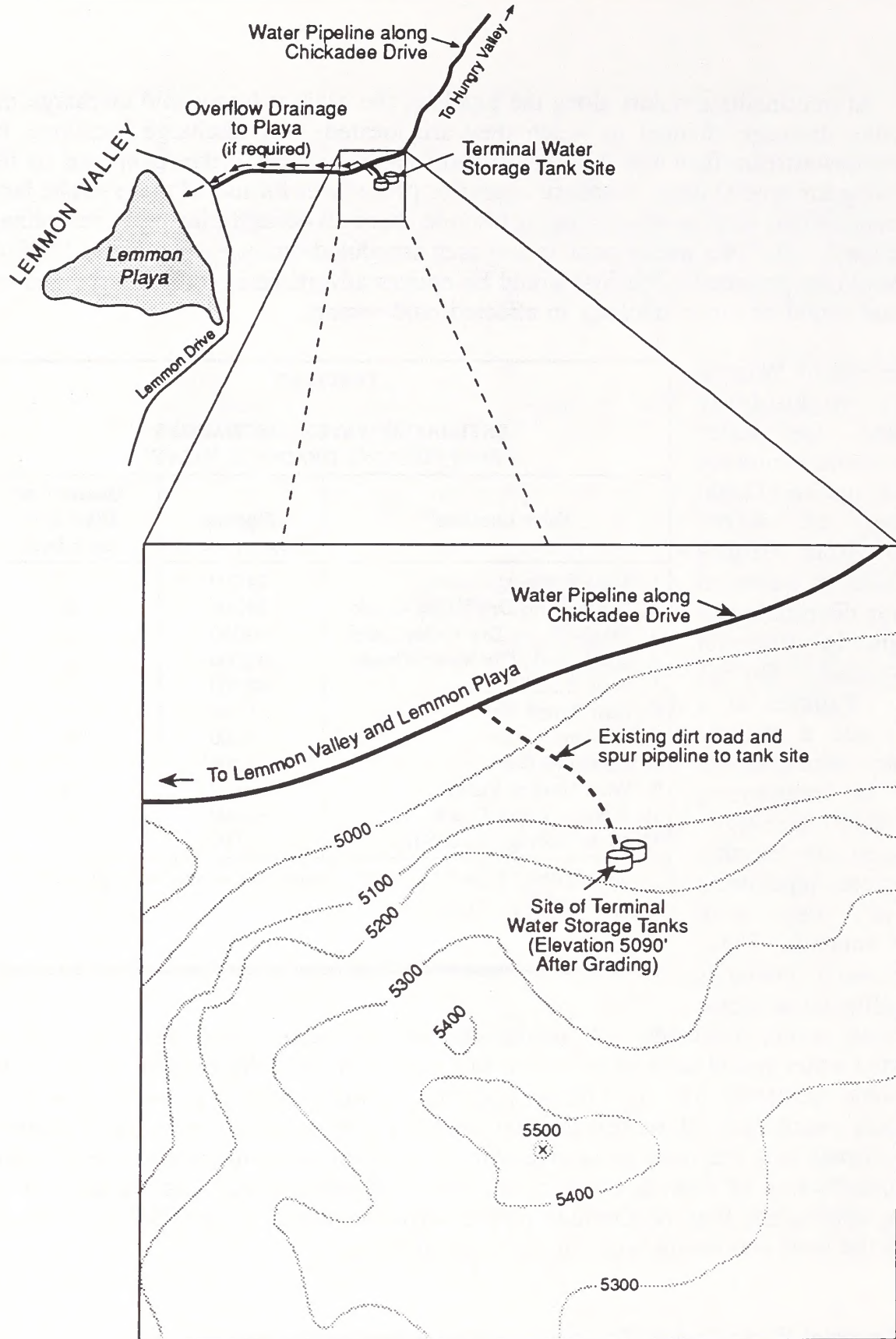


Figure 2-3

Site of Terminal Water Storage Tanks In Lemmon Valley

NEVADA



0 500

FEET
(detailed view)

Contour Interval=100 feet

One 2.5-million-gallon water-storage tank would be built initially, with a second tank of the same size added when required. Each water tank would be 105 feet in diameter, 40 feet high, and constructed of welded steel. An area encompassing approximately two acres of public land surrounding the tank site would be fenced.

A buried lateral extension of the water pipeline would be constructed to the water-storage tanks. A 100-foot-wide construction zone would be required along an existing half-mile dirt road that connects Chickadee Drive to the tank site, disturbing approximately three acres of public land (Figure 2-3).

The water-storage site would be graded level to minimize the possibility of differential settling (Figure 2-4). Cut slopes would be terraced and planted with native vegetation for appearance and erosion control. The site would be fenced to protect valves and controls, and the water tanks would be painted with a suitable color to blend in with the surrounding visual setting to the extent possible.

An overflow and drainage system would be constructed from the water-storage tanks to Chickadee Drive for draining the tanks and in the event that they inadvertently overflow. The drain would extend along Chickadee Drive approximately two miles and discharge into a large playa in Lemmon Valley (Figure 2-3). The drain would consist of culverts and open channels, similar to the existing drainage system in the area, and would be built to standards of the Washoe County Road Division. Where the drain crosses public lands, it would be within the proposed right-of-way; otherwise, it would be on private land. The drain would be sufficiently large to avoid overflow of water and resulting soil erosion.

2.1.2.3 Gas Pipeline

The proposed route of the gas pipeline is shown on Figure 2-1. Construction of the gas pipeline would follow the same procedures described for the water pipeline (see Section 2.1.2.1). Surplus earth materials from excavation of the trench would be negligible.

The gas pipeline would be 58 miles long, of which 29 miles would be contiguous with the route of the proposed water pipeline. It would tap into the existing Paiute gas pipeline near Wadsworth, Nevada, where a gas meter and a regulator would be installed on private land. From this point, the gas pipeline would proceed along the road up Olinghouse Canyon, ascend the crest of the Pah Rah Range on a combination of public and private lands, and descend into Warm Springs Valley along existing roads. The gas line would intersect Pyramid Highway (Route 445) near the BLM's *Palomino Valley Wild Horse and Burro Center*, follow the highway southward for about two miles, cross underneath the highway, and then turn westward along existing roads on private and public lands to the intersection of the water pipeline in northern Hungry Valley. From there, the gas pipeline would be constructed within the same right-of-way corridor as the water pipeline through Bedell Flat to its terminus in Honey Lake Valley.

From the existing Paiute pipeline to its intersection with the proposed water pipeline in northern Hungry Valley, the gas pipeline would be about 29 miles long. It would cross six

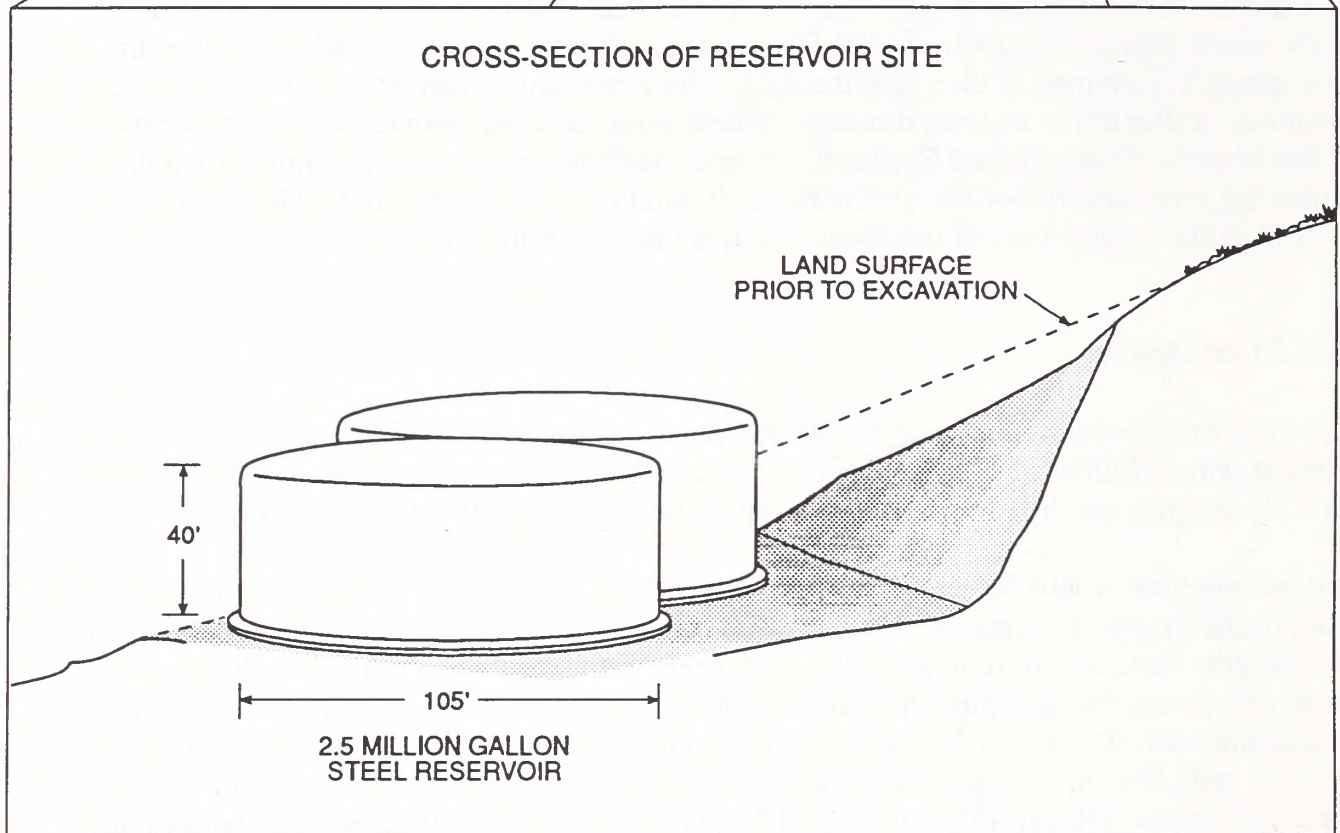
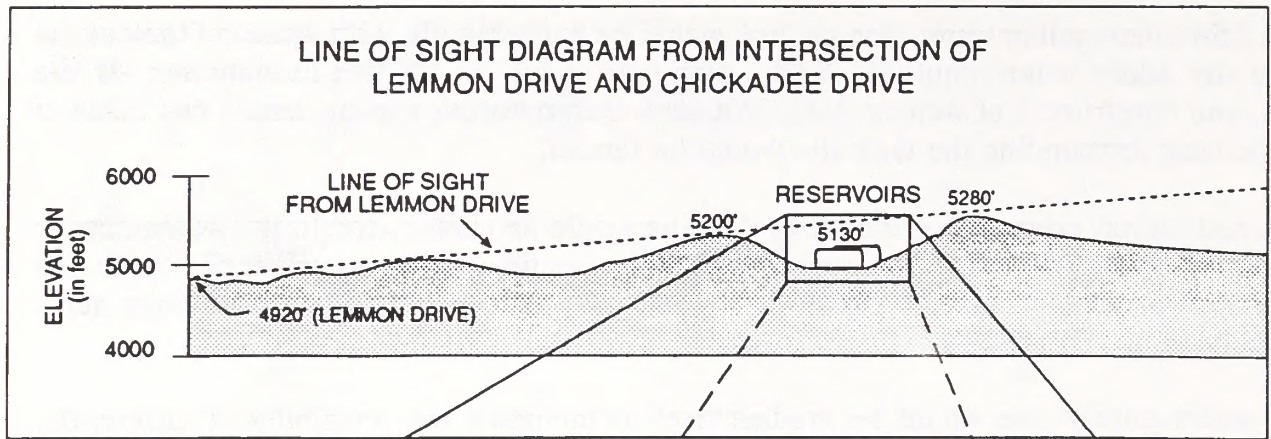


Figure 2-4

Cross-Section of Reservoir Site



NOT TO SCALE

miles of public land, of which 4.7 miles would be along existing roads. A 100-foot-wide right-of-way would be required for construction of the gas pipeline along this 29-mile segment.

The gas pipeline would be constructed of six-inch-diameter coated steel and would operate at a pressure of between 300 and 400 pounds per square inch. The line would be buried to a depth of approximately three feet throughout its 58-mile extent. Signs warning people of the pipeline would be placed at intervals along the route in conformance with applicable regulations. Valves and other structures associated with the pipeline would be installed at specified intervals; these structures would be visible only from short distances away because they would protrude only slightly above the ground surface.

In areas where the gas pipeline right-of-way would be close to existing roads, the entire 100-foot-wide disturbed area would be reclaimed in consultation with the BLM. In areas where no roads exist, the entire disturbed area, except for a 15-foot-wide maintenance road and some maintenance areas, would be reclaimed.

2.1.3 Ancillary Facilities

Facilities to be constructed in Honey Lake Valley and in Lemmon and Spanish Springs Valleys are not part of the proposed Bedell Flat rights-of-way. Except for a 1.3-mile segment of the well-collection pipeline system that would cross small parcels of public land along the county road in Honey Lake Valley, all facilities in Honey Lake Valley, Lemmon Valley, and Spanish Springs Valley would be located on private land and along existing or proposed county roads. These facilities are not part of the proposed action for this EIS. They are described briefly in the following sections because they are related to the proposed action (Figure 2-5).

2.1.3.1 Well Field and Related Facilities

Ten supply wells would furnish all the water to be pumped through the proposed pipeline. Five wells exist, but they would be redrilled to applicable standards. Five new wells would be constructed. A buried well-collection pipeline system would be constructed to convey water from the 10 wells to the main pumping station.

Four natural-gas-fired turbine generators would supply all of the electrical power needs of the project. Power lines would be constructed alongside existing roads from the power station to each of the well-sites.

The main pumping station would house the pumps that lift the water out of Honey Lake Valley, as well as a 0.5-million-gallon water-storage tank. Fuel oil would be used as a back-up energy supply in the event of a disruption in the supply of natural gas. The fuel oil would be stored in two underground tanks, each with a capacity of 20,000 gallons.

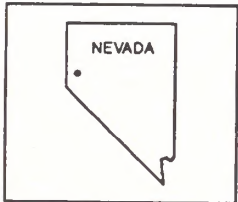
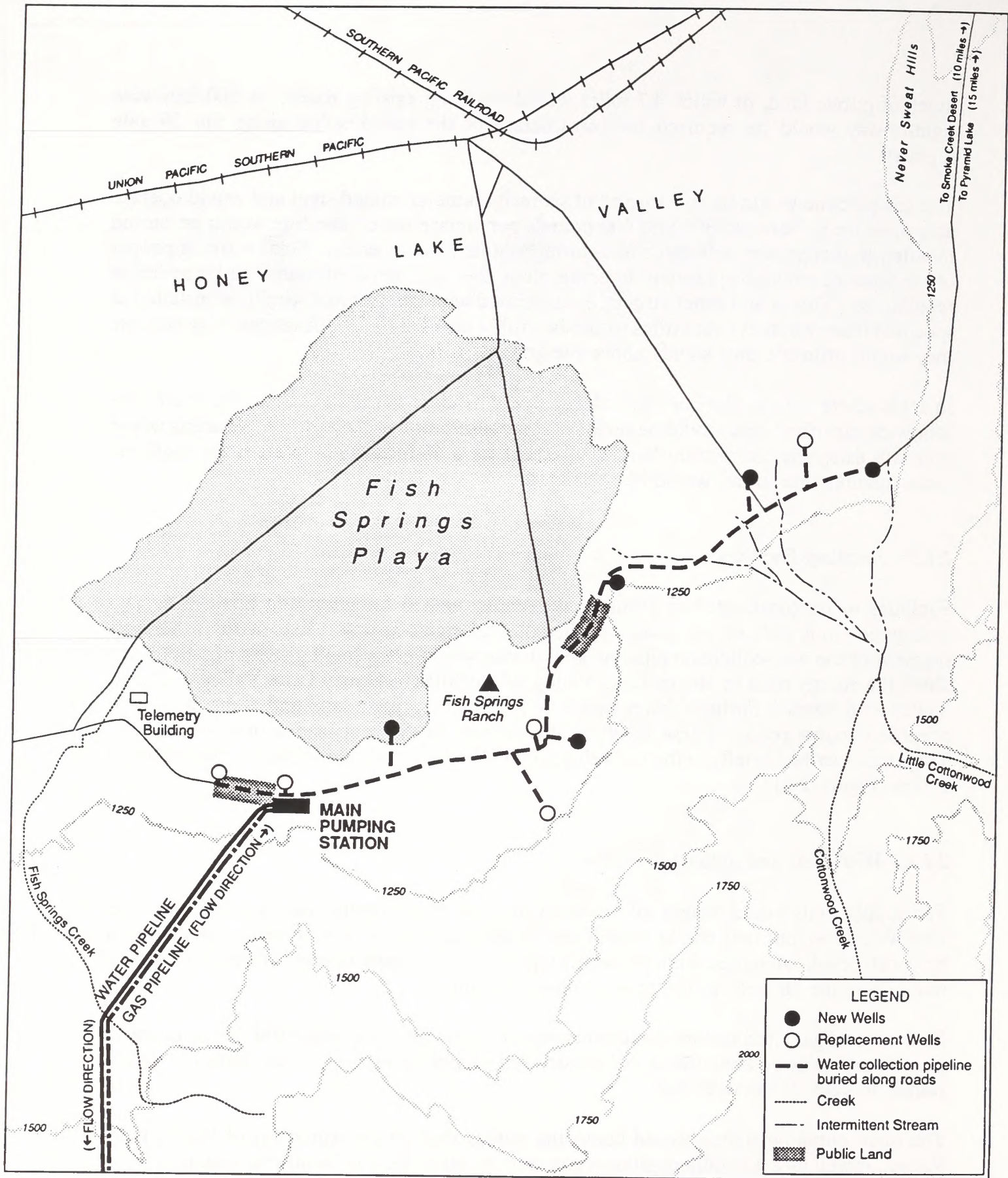
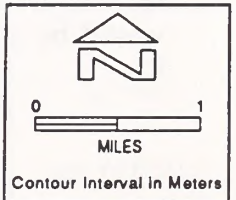


Figure 2-5
Ancillary Facilities In Honey Lake Valley



No federal or state drinking-water regulations currently exist that require disinfection of groundwater supplies as long as the water meets primary and secondary drinking-water standards set forth in Nevada Administrative Code 445.247 and 445.248 (Sandoval, 1991). In several years, however, federal regulations may require groundwater to maintain detectable disinfectant residuals, similar to existing regulations for surface-water drinking supplies. Therefore, design of the project includes three 1,500-gallon tanks for the storage of disinfectant for peak operations approximately 20 years after start up. Sodium hypochlorite would probably be used as the disinfectant, which is comparable to household bleach.

Radon gas, formed by the natural decay of radium, is colorless, odorless, and occurs in much of the groundwater in the western United States, including virtually all of the groundwater in Washoe County. Radon levels in the well-field groundwater in Honey Lake Valley range from 300 to 1,300 picocuries per liter (data from Washoe County). The Environmental Protection Agency (EPA) is now in the process of establishing drinking-water standards for radon in groundwater. It is likely that some level of radon removal will eventually be required; therefore, design of the facilities in Honey Lake Valley includes provisions for radon removal by means of diffused bubble aeration.

A telemetry system would be installed in Honey Lake Valley for communications. Water demand in Lemmon and Spanish Springs Valleys would be measured by the water levels in the water-storage tanks which, in turn, would control the operation of the power generating system, the well pumps, and the disinfection and radon-removal systems in Honey Lake Valley. For transmission of signals between the main pumping station, the water-storage site in Lemmon Valley, and the headquarters of the Washoe County Utilities Division in Reno, a telemetry building would be constructed on private land in Honey Lake Valley a few miles northwest of the pump station. The existing Slide Mountain Repeater Station located 15 miles south of Reno would be used as a relay station.

2.1.3.2 Delivery/Use Area

Approximately 10 million gallons of additional water-storage capacity would be required at as-yet unknown locations in Lemmon and Spanish Springs Valleys. In addition, an estimated 10 miles of new water-distribution lines would be required as these valleys are developed.

2.1.4 Workforce and Material Requirements

2.1.4.1 Construction Workforce and Equipment

An estimated total of 40,000 person-days over a period of nine months would be required to construct the pipelines and the associated facilities from Honey Lake Valley and Lemmon Valley. Table 2-3 shows the estimated total hours of operation for each piece of heavy and light-heavy equipment that would be used during construction of the project. Construction crews would be hired from the local workforce to the extent possible.

2.1.4.2 Operational Workforce and Equipment

During operation, workforce requirements would be largely in the areas of equipment performance and observation, preventative maintenance, normal repair work, and record keeping. This work would include monthly tours of the water and gas pipelines and weekly visits to the site of the water-storage tanks in Lemmon Valley.

On-site operation and maintenance of the facilities in Honey Lake Valley would be provided by four Washoe County employees on a year-around basis. Housing for these people and their families would be furnished by Washoe County on private land near the pumping station.

2.1.4.3 Material Requirements

• Construction

A variety of man-made materials would be required for construction of the pipelines (Table 2-4). Most of these materials would not be available from vendors in the Truckee Meadows area.

• Operation

The primary materials required during operation would be disinfectant and natural gas. Fuel oil would be required in the event of a disruption in gas service, but this is expected to be infrequent. The cost of these materials at full operation is approximately \$1,000,000 per year.

TABLE 2-3	
PROJECTED USE OF CONSTRUCTION EQUIPMENT (during 9-month period)	
Equipment	Hours of Operation
Backhoe #1	8,256
Backhoe #2	4,106
Truck Crane	3,038
Bulldozer	1,888
Front End Loader	7,808
Motor Grader	400
Van or Personal Vehicle	12,000
Rotary Drill	2,400
Dump Truck	4,652
Water Truck	1,964
Truck, Semi w/Flat Bed	1,292
Electric Truck W/Auger	64
Pickup Truck	5,980
Concrete Mix Truck	480
Vibratory Compactor	18,548
Vibratory Roller	32
Arc Welder #1	27,200
Arc Welder #2	12,208
Well Test Pump	720
Source: Washoe County	

TABLE 2-4	
MATERIALS REQUIRED FOR CONSTRUCTION OF THE WATER AND GAS PIPELINES	
• 36" Water Transmission Pipe (39 miles) Fittings, distribution pipe, valves, cathodic protection • 6" Gas Transmission Pipe (58 miles) Fittings, valves and regulators, and cathodic protection • Terminal Water-Storage Reservoirs Two 2.5 million-gallon tanks, regulating equipment, valves and piping • Concrete and Reinforcing Steel 1,200 cubic yards of concrete, and 65,000 pounds of reinforcing steel	
Source: Washoe County	

2.1.5 Measures Proposed by Washoe County to Minimize Environmental Impacts and Proposed Monitoring

2.1.5.1 Measures to Minimize Environmental Impacts

On November 24, 1992, the Washoe County Commission amended its right-of-way applications to include measures to minimize or eliminate the indirect environmental impacts potentially caused by the *Truckee Meadows Project* on threatened and endangered species, wetlands, and domestic well users. On December 15, 1992, the Washoe County Commission further amended their right-of-way applications to include measures to minimize or eliminate direct environmental impacts associated with pipeline construction. All these measures are described below.

- ***Measures to Minimize Adverse Impacts to Threatened and Endangered Species***

Pursuant to an Interlocal Agreement among the Cities of Reno and Sparks and Washoe County, and pursuant to the *Truckee Meadows Regional Plan* approved March 21, 1991, the county acts as the Regional Water Resource Management Agency for the local area. The county is charged with the management of water quality and water quantity regimes in order to protect the environment of the area as well as to provide and coordinate water supplies for the Truckee Meadows and surrounding areas. The county is committed to accomplishing the following programs of impact prevention to protect the endangered cui-ui and the threatened Lahontan cutthroat trout of Pyramid Lake.

Astor Pass Protection Measures

Computer modeling for the EIS indicates that project pumping would reduce groundwater inflow to Pyramid Lake through Astor Pass by 547 acre-feet of water annually. As described in the next paragraph, the county would mitigate this potential impact "up front" prior to any pumping of water in Honey Lake Valley for delivery to Lemmon and Spanish Springs Valleys.

The county would acquire and dedicate Truckee River water rights to the Bureau of Indian Affairs to be held in trust for the benefit of the cui-ui and Lahontan cutthroat trout in order to provide replacement water for the potential reduction in flow of 547 acre-feet of groundwater annually through Astor Pass to Pyramid Lake. The place of use of the water rights shall be changed to Pyramid Lake for the beneficial use of the threatened and endangered fish of Pyramid Lake. The goal of the county and the U.S. Fish and Wildlife Service is to provide a reasonable method of replacing 547 acre-feet of water annually on a long-term average. Credits for shortfalls for drought years can be accumulated, and shortages shall be compensated for in non-drought years. Average actual flow over a long-term basis is the key to the program; timing of the flow during the year is not an issue because it is replacement of groundwater flow.

Prior to pumping water in Honey Lake Valley for delivery to Lemmon and Spanish Springs Valleys, the county must determine the actual specific method of acquiring Truckee River

water rights and implementing the mitigation. The U.S. Fish and Wildlife Service has agreed to informally review the replacement method in order to assist the county in determining the reasonableness of the approach.

The county agrees to make this "up front" mitigation plan a condition of the right-of-way grants. Re-initiation of Section 7 consultation would occur if the U.S. Fish and Wildlife Service determines that the mitigation plan and its implementation (a) does not reasonably eliminate adverse impacts to the threatened and endangered fish of Pyramid Lake, or (b) provides more or less replacement water than is necessary to mitigate the adverse impacts to these fish.

Sand Pass to Smoke Creek Desert and Terraced Hills to Pyramid Lake Basin

The Smoke Creek Desert groundwater basin is a large hydrographic basin with an estimated annual recharge of 16,000 acre-feet of water; it is located northeast of Honey Lake Valley (Figure 1-2). Computer modeling for this EIS predicts a potential reduction of groundwater flow of 2,300 acre-feet annually from Honey Lake Valley through Sand Pass to the Smoke Creek Desert as a result of project pumping of 13,000 acre-feet annually.

The U.S. Geological Survey is completing a study of the Smoke Creek Desert groundwater basin. Preliminary results of this study suggest that there may be groundwater flow from the Smoke Creek Desert southward through the Terraced Hills to Pyramid Lake. Hence, the predicted reduction in groundwater flow from Honey Lake Valley to the Smoke Creek Desert caused by the project could also reduce groundwater inflow to Pyramid Lake, thereby adversely affecting the threatened and endangered fish in Pyramid Lake.

Washoe County agrees to mitigate this potential reduction in flow to Pyramid Lake caused by project pumping. Because of the uncertainties associated with this reduction, one of the following three methods would be used by the county to reasonably determine how much replacement water from the Truckee River is necessary for mitigation:

1. Develop an analytical model based upon currently available information, using conservative assumptions. The county and its consultants may perform the analytical work. The U.S. Fish and Wildlife would review the analyses and determine if the calculations and results are acceptable to the Service. If, during the first ten years of project pumping, monitoring revealed different impacts (either more or less) than determined by the original analytical model, adjustments to the mitigation would be made by the county.
2. The capacity of the groundwater computer model used for the EIS would be expanded to quantify the hydrologic connection through Sand Pass and under the Terraced Hills. The county (or its contractor) would be responsible for collecting the field data necessary to expand the model and for making the modifications to the model that would result in reasonable estimates of the groundwater connection. Such data collection and modeling would commence during the period between the issuance of the rights-of-way to the county by the BLM and the commencement of project pumping. The data collection and modeling would be completed as soon as

practical thereafter (estimated at 2-3 years). Upon completion of the study, the county would purchase and transfer to Pyramid Lake the amount of water equal to the reduced inflow predicted by the expanded model. If this option is selected, this mitigation plan would be a condition of the right-of-way grants.

3. The county would purchase and transfer to Pyramid Lake 2,300 acre-feet of water (assumes the worst-case impact).

Upon determining which of the three methods would be initiated, the county shall provide the replacement of any reduced flow of groundwater through the Terraced Hills to Pyramid Lake Valley in the same manner as discussed under Astor Pass. The county agrees to make these protective measures a condition of the right-of-way grants.

- *Measures to Minimize Adverse Impacts to Wetlands*

All existing water rights on Cottonwood Creek (located a few miles east of the ranch) would be purchased by Washoe County and, pursuant to the county option dated April 12, 1988, changed from their current point of use for alfalfa production near Cottonwood Creek, to wetlands mitigation at the ranch. The alfalfa fields would be abandoned and the water from Cottonwood Creek (441.8 acre-ft/yr under Permits 18107 and 18821 and Proof 02436) would be transported via pipes and ditches to an existing 200-acre wetland at the ranch. Livestock would be excluded from this wetland.

- *Measures to Minimize Adverse Impacts to Domestic Well Users*

The county would offer a one-time deepening of domestic wells that are within the area where drawdown is predicted to be greater than 20 feet and that are in use on the date that the rights-of-way are granted. The amount of well deepening would be twice the amount of the predicted drawdown.

- *Measures to Minimize Adverse Impacts During Pipeline Construction*

Private property owners affected by project construction would be fully compensated pursuant to Chapter 37 of the Nevada Revised Statutes. Washoe County would restore and replace to pre-construction conditions all range improvements (i.e., fences and watering facilities) that are damaged or destroyed during construction. Stock-watering tanks in Bedell Flat would be buried.

All areas disturbed during construction would be promptly reclaimed by reseeding with appropriate seed mixtures. Off-road vehicle use of roads created for construction would be prohibited by Washoe County to the extent possible.

To minimize disruption of cattle grazing, construction schedules would be discussed with livestock operators and altered if appropriate. Construction would be avoided in the Seven Lakes area from November 1 to March 31 and in Bedell Flat from March 1 to May 1 to avoid conflicts with wildlife (Figure 2-1). No construction would occur in active raptor-nesting areas for a period determined in a pre-construction raptor survey. All known

archaeological sites would be avoided. Archaeologists would be retained on site during construction to avoid impacts to cultural resources that may have been missed during pre-construction surveys. Finally, construction crews would be educated with regard to the importance of cultural resources.

2.1.5.2 Monitoring

Included in their amended right-of-way applications of December 15, 1992, the Washoe County Commission included a preliminary environmental monitoring and management plan. Prior to the commencement of pumping for exportation, Washoe County would develop a final monitoring and management plan in consultation with several governmental agencies (described below).

- ***Environmental Protection Standards***

The following standards would be used to identify impacts for which environmental protection measures would be developed:

1. Changes in existing conditions which are prohibited by Federal or State statute or applicable local ordinance or decree of any court having jurisdiction.
2. Changes in existing conditions that Washoe County has foresworn by agreement with another party.
3. Changes in existing conditions that Washoe County has foresworn by adoption of a self binding public policy.

- ***Monitoring Committee***

The monitoring data collected by Washoe County (or its contractors) shall be submitted to a monitoring committee composed of representatives from the U.S. Geological Survey, Nevada Department of Environmental Protection, Nevada State Engineer's Office, U.S. Bureau of Land Management, U.S. Fish and Wildlife Service, the Sierra Army Depot, and Washoe County.

The monitoring committee would meet to review the data, identify and analyze the effects of the pumping, and determine if further monitoring stations are necessary. With the aid of computer models developed for this EIS, the county would provide the committee with predictive model runs based on the monitoring data.

All data collected and the results of computer modeling shall be disseminated to the public. The budget for monitoring activities must be approved by Washoe County and the U.S. Geological Survey.

In addition to the environmental management activities described elsewhere in this plan, other procedures may be adopted by the committee. If there is an affirmative legally

recognized duty to take action to avoid or minimize environmental impacts, the county must comply through the monitoring plan. If no such legal duty exists, the committee shall recommend appropriate alternatives and work with the county toward their implementation.

To the extent that federal law does not control, the Nevada State Engineer retains jurisdiction on groundwater decisions. In his Ruling on the inter-basin transfer of water, the State Engineer also required groundwater monitoring in certain locations in Honey Lake Valley. The committee shall exchange information that is developed by the county pursuant to the State Engineer's required groundwater monitoring plan in the event that this plan is separate from the monitoring plan described below.

- *Provisional Monitoring Plan*

The following provisional monitoring plan is the foundation of the ultimate monitoring plan to be implemented for the Project. The monitoring plan would take many years to develop and would be responsive to impacts that occur after completion of the Project's well field and facilities. The monitoring plan would be updated as needed by the county and the monitoring committee to reflect future conditions and to coordinate with the monitoring needs of the Sierra Army Depot. Washoe County encourages the participation of the Pyramid Lake Paiute Tribe in the development and implementation of the monitoring plan. The provisional plan set forth here is based on the predicted impacts described in this EIS (Chapter 4) and is committed as a starting point for the development of the monitoring plan. The following discussion is divided into the resource areas to be monitored.

Vegetation

Upon issuance of the rights-of-way by the BLM, several 150-foot-long transects would be established within the drawdown area. Each transect would be permanently staked. The number and location of transects would be agreed upon by the committee. At each transect, baseline measurements would be made of plant species, plant frequency, vigor, and percent cover for the dominant species of phreatophytes, as well as for the dominant non-phreatophytic shrubs. The number and location of transects would be agreed upon by the committee. Several control transects would also be established outside the drawdown area. Each control transect would be permanently staked and sampled in the same manner as the transect in the drawdown area. Historical LANDSAT TM data are available to establish the variability and range of the pre-development conditions in Honey Lake Valley.

At a minimum, each transect would be surveyed in the spring (at the beginning of the growing season) and again in late summer or early fall. At intervals along each transect, cover would be recorded in the form of live vegetation by species, litter, rock, and bare ground. Percent cover, frequency, species composition, and other parameters would be developed from the line transect. Because shrubs are an important issue, a belt six-feet wide from the center line would be surveyed for shrubs by species. Shrubs would also be recorded by height class to quantify reproduction. Plant vigor, measured as production, would also be evaluated. Herbaceous growth and annual shrub leader growth would be sampled (clipped) by species, air-dried, and weighed to quantify production. Plant density, measured by numbers of plants by species, would also be recorded.

Domestic livestock, wild horses, and wildlife such as mule deer all utilize forage resources. The effects of this utilization are variable and difficult to quantify, and may make the evaluation of effects of groundwater pumping difficult to isolate. For this reason, some transects may be fenced.

Color photographs would be taken at each transect during spring and late summer/fall surveys. In addition, LANDSAT TM images could be obtained annually or every other year to document the type, areal extent, and condition of the vegetation.

Climatological information would be gathered at Fish Springs Ranch and from other established stations in Honey Lake Valley for comparison and possible correlation to changes in vegetation and wetlands.

Wetlands

Several representative wetlands would be selected for monitoring (Bonham Ranch, High Rock Spring, Duck Lake, and the wetlands at Fish Springs Ranch; the precise number and location of wetlands to be monitored would be agreed upon by the committee). Photograph points would be established and permanently staked at each wetland. The dimensions of any surface waters at each wetland would be recorded by a combination of mapping and/or pacing. Dominant vegetation and other general characteristics would be recorded. Several control wetlands would also be established outside the drawdown area in Honey Lake Valley. A permanent photograph point would be established at each control wetland and baseline conditions would be characterized in the same manner as the wetlands in the drawdown area.

Field surveys at each wetland would be conducted in the spring and fall. In addition to photographs, general conditions of each wetland would be documented, including types of vegetation and wildlife. Low-altitude infrared photography would be flown each spring to quantify changes in the size of each wetland. Infrared photographs could be used to document the extent and vigor of vegetation.

Air Quality

A data-collection program would be developed for the eastern side of Honey Lake Valley. The program would operate for a period of two years to establish baseline air-quality conditions with regard to PM_{10} . If vegetation monitoring demonstrates that vegetative cover is being reduced due to pumping for the *Truckee Meadows Project*, a more intensive air-quality monitoring program would be initiated.

Three air-quality monitoring sites would be established in eastern Honey Lake Valley (Fish Springs Ranch, High Rock Ranch, and the Sierra Army Depot; the precise number and location of sites would be agreed upon by the committee). At each site, two High-Volume PM_{10} samplers would be installed (these samplers have a vacuum motor which runs continually during operation, requiring a reliable 115 volt power source). At each of the three sites, samples would be taken every six days during periods of active sampling and forwarded to the Washoe County Air Quality Division for weighing.

Groundwater and Surface Water

The purpose of this monitoring program is to develop a data base to document changes that occur in groundwater levels and water quality in the area affected by pumping. This information would be used for well field management and model validation. The elevations and locations of monitoring wells would be surveyed to allow the determination of hydraulic gradients. Monitoring would begin approximately six months prior to the export of groundwater from Honey Lake Valley. The monitoring would be accomplished by a combination of the efforts of the Nevada Division of Water Resources and Washoe County. In addition, information collected by the Sierra Army Depot would be incorporated into the monitoring data base.

The water-production wells used for the *Truckee Meadows Project* would be equipped with flow meters that would record the cumulative well production. The cumulative well-production would be recorded once per month along with a manual measurement of the depth to the water table at the production well. Maintenance workers or other regulatory-mandated personnel would collect water-quality samples that may be required to comply with the Safe Drinking Water Act and other applicable water-quality standards, if any. In addition, water-quality samples would be collected on a quarterly basis and analyzed for the following parameters: *total dissolved solids (TDS), electrical conductivity (EC), pH, sodium, calcium, magnesium, potassium, chloride, nitrate, sulfate, carbonate, bicarbonate, arsenic, and boron*. Access to the well field would be provided to personnel of the Nevada Division of Water Resources for monitoring well production, measuring water levels, and sampling water quality.

Two monitoring wells would be constructed within 1,000 feet of each of the water-production wells. Maintenance staff would measure the water levels monthly on the same day as the water levels are measured for the associated production wells. Water-quality samples would also be collected and analyzed on a quarterly basis for the parameters listed in the preceding paragraph. Access would be provided to personnel of the Nevada Division of Water Resources for measuring water levels and sampling water quality.

The proposed well-monitoring sites described in the following paragraphs are shown on Figure 2-6. Washoe County or its appointee would collect and analyze samples from these wells for the following water-quality parameters: *total dissolved solids (TDS), electrical conductivity (EC), pH, sodium, calcium, magnesium, potassium, chloride, nitrate, sulfate, carbonate, bicarbonate, and carbonate*. Wells would be sampled on a semi-annual basis for the first two years of the monitoring program. In subsequent years, water quality sampling would consist of one annual sample collected in the summer.

- Three new sites for monitoring wells would be developed in Nevada adjacent to the California border (Figure 2-6; the southern-most well along the state-line shown in this figure already exists). Each site would be equipped with a well or wells that would allow separate monitoring of water levels and quality from three levels within the aquifer. The upper zone to be monitored is the portion of the aquifer located approximately between 20 and 50 feet below the water table. The middle zone would be approximately 100 to 150 feet below the water table, and the lower zone from 350 to 400 feet below the water table.

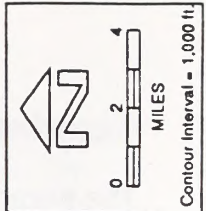
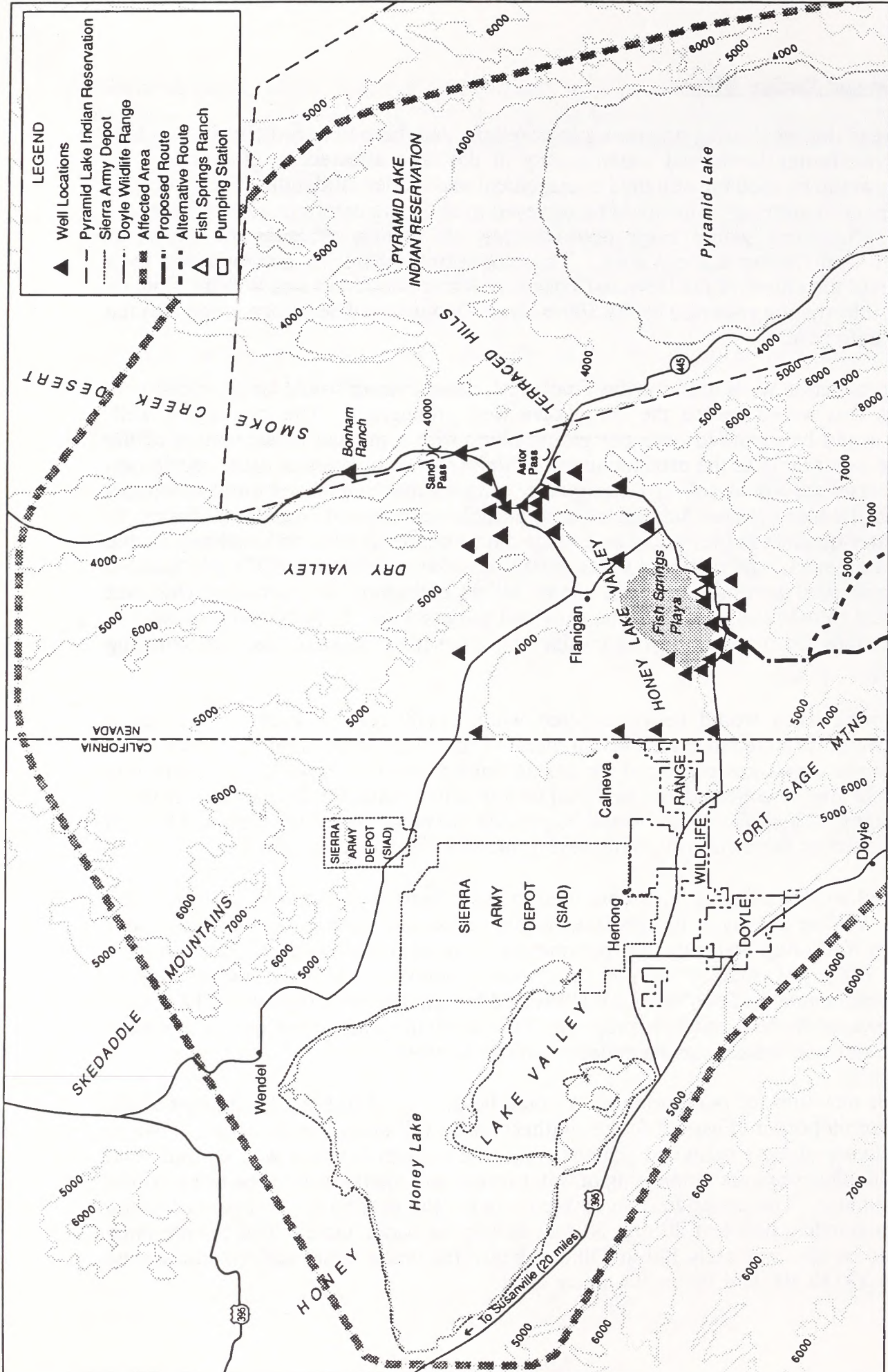
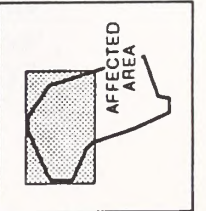


Figure 2-6

Location of Existing and Planned Monitoring Wells

(Plate I, in a pocket at the end of the Appendices Volume A, is a detailed view of this area.)



- At Sand Pass, five existing wells and one new well would be monitored. The new monitoring well is expected to be completed in fractured rock.
- At Astor Pass, four existing and two new monitoring wells would be developed. The new wells are expected to be completed in fractured rock.
- In Dry Valley, several miles west of the Smoke Creek Desert, three wells would be monitored. One of the wells is an existing stock well. The two other wells would need to be constructed to a depth of 300 to 400 feet below land surface.
- In Cottonwood Creek, three existing wells would be monitored. A weir would be installed on Cottonwood Creek above the irrigation diversion. Stream flow and water quality would be monitored on a quarterly basis.
- Water flow and quality for approximately ten other wells on the Nevada-side of Honey Lake Valley would be monitored. Eight of these wells exist.
- One monitoring site would be constructed at Bonham Ranch in the Smoke Creek Desert. The site would be equipped with a well or wells that would allow separate monitoring of water levels and quality from three levels within the aquifer. The upper zone to be monitored is approximately between 10 and 30 feet below the land surface. The middle zone is approximately 75 to 100 feet below the land surface, and the lower zone is from 150 to 200 feet below the land surface. Arsenic and boron would be added to the list of water-quality parameters to be tested at this site.

2.1.6 Standard Operating Procedures Used to Safeguard Natural Resources

Washoe County, as the rights-of-way holder, would also be required to comply with BLM standard operating procedures for the use of public lands as required by law, regulation, land use plan, and other BLM guidance. These procedures and conditions are as follows:

1. During the pre-construction and construction periods, the BLM will make modifications to any right-of-way when it is necessary to maintain stability of geologic materials, fish and wildlife habitats, the environment, and the public interest.
2. The BLM will, if necessary, suspend any construction and maintenance activities if there is an immediate threat to life (including wildlife and aquatic life), property, or the environment.
3. The holder shall abate any conditions existing that could potentially cause irreparable harm or damage to any person or property.
4. Existing roads and trails will be used whenever possible during construction.
5. The holder shall permit free and unrestricted public access to and upon the right-of-way for all lawful and proper purposes, except in areas designated as restricted by the BLM in order to protect the public safety or facilities constructed on the right-of-way.

6. The holder shall use every reasonable means to minimize erosion and soil damage in connection with construction, rehabilitation, or maintenance operations under a right-of-way grant, including (but not limited to) construction of waterbars, cross ditches, or other structures.
7. The holder shall remove or dispose of all waste in accordance with a plan approved by the BLM Area Manager and in a manner consistent with federal, state, and local laws and regulations.
8. Revegetation of disturbed lands will be required as specified by the BLM. The appropriate seed mixture and proper planting techniques will be specified by the BLM.
9. The holder's activities in connection with the project in key fish and wildlife areas will, when necessary, be restricted by the BLM during periods of fish and wildlife breeding, nesting, spawning, lambing or calving activity, and during major migrations of fish and wildlife.
10. All operations under right-of-way grants shall be conducted in such a manner as to avoid (a) permanent blockage of any drainage system; (b) changing the character of, or causing the pollution or siltation of, rivers, streams, reservoirs, ponds, water holes, or springs; and (c) damaging fish and wildlife resources and habitat.
11. The holder will take such measures that are necessary to assure unrestricted passage and movement of fish and wildlife. No artificial structure or stream channel alteration that would cause a blockage to the movement of fish and wildlife will be allowed.
12. The holder shall construct, maintain, operate and/or modify structures or facilities as directed by the BLM to protect and minimize adverse effects upon raptors and other wildlife.
13. The holder shall comply with state and federal laws that are applicable to the authorized use of public lands, and such additional state and federal laws, along with their implementing regulations, that may be enacted and issued during the term of the grant.
14. The holder shall comply with the construction practices and mitigating measures established by 33 CFR 323.4, which set forth the parameters of the "nationwide permit" required by Section 404 of the Clean Water Act. If the proposed action exceeds the parameters of the nationwide permit, the holder shall obtain an individual permit from the U.S. Army Corps of Engineers and provide the BLM Area Manager with a copy of this permit. Failure to comply with this requirement shall be cause for suspension or termination of the right-of-way grant.
15. The holder shall comply with the Toxic Substances Control Act of 1976, as amended (15 U.S. C. 2601, et seq.), with regard to any toxic substances that are used, generated by, or stored on the right-of-way or on facilities authorized under the right-of-way grant (see 40 CFR, Parts 702-799, and especially provisions on

polychlorinated biphenyls at 40 CFR 761.1-761.193). Additionally, any release of toxic substances (leaks, spills, etc.) in excess of the reportable quantity established by 40 CFR, Part 117, shall be reported as required by the Comprehensive Environmental Response, Compensation and Liability Act of 1980, Section 102b. A copy of any report required or requested by any federal agency or state government as a result of a reportable release or spill of any toxic substances shall be furnished to the BLM Area Manager concurrent with the filing of the reports to the involved federal agency or state government.

16. Air quality will be protected through compliance with the Clean Air Act of 1990 and all other federal, state and local emission standards for air quality. Section 176(c) of the Clean Air Act (42 U.S.C. 7506) states that "No department, agency, or instrumentality of the Federal Government shall engage in, support in any way or provide financial assistance for, license or permit, or approve, any activity which does not conform to an implementation plan after it has been approved or promulgated under Section 110 [of the Clean Air Act]."
17. The holder shall rebuild or repair roads, fences, and established trails that may be destroyed or damaged by construction, operation or maintenance of the project, and to build and maintain suitable crossings for existing roads and significant trails that intersect the project.
18. The holder shall ensure that activities in connection with the grant shall not violate applicable water quality standards or related facility siting standards established by or pursuant to applicable federal or state laws.
19. The holder shall prevent or control damage to scenic, aesthetic, cultural and environmental values (including damage to fish and wildlife habitat), damage to federal property, and hazards to public health and safety.
20. The holder shall comply with state standards for public health and safety, environmental protection and siting, construction, and operation and maintenance when those standards are more stringent than federal standards.
21. Any cultural and/or paleontological resource (historic or prehistoric sites or objects) discovered by the holder, or any person working on its behalf, during the course of construction and/or maintenance on public or other federal land, shall be immediately reported to the BLM Area Manager. The holder shall suspend all operations in the immediate area of such discovery. An evaluation of the discovery will be made to the Area Manager, in consultation with the State Historic Preservation Officer, pursuant to the direction and criteria of Section 106 of the National Historic Preservation Act. This evaluation will determine whether the discovery is eligible for the National Register of Historic Places and what mitigation measures are necessary to protect it. The holder will be responsible for the cost of evaluation, and any decision as to proper mitigation measures will be made by the Area Manager after consulting with the holder. Operations may resume only upon written authorization to proceed from the Area Manager.

22. No threatened species, endangered species, or species proposed for listing or their habitats shall be impacted without first completing consultation with the U.S. Fish and Wildlife Service per the Endangered Species Act. Nor shall any candidate species be impacted to the extent that the impact could lead to its listing as threatened or endangered, per BLM policy.
23. The holder shall submit a plan of development prior to issuance of the grant that addresses specific construction, operation, maintenance, and/or termination features which will satisfactorily mitigate the impacts.
24. The holder shall prepare a fire prevention and suppression plan that shall be subject to BLM approval. The holder shall take into account such measures for prevention and suppression of fire on the rights-of-way and other public land used or traversed by the holder in connection with operations of the rights-of-way.

2.1.7 *Costs of the Truckee Meadows Project*

Estimated costs for the *Truckee Meadows Project* are shown on Table 2-5. Total project costs, which include all facilities and equipment required to deliver water to Lemmon Valley and Spanish Springs Valley and the acquisition of water rights, are estimated to be \$115,500,000. Financing costs are estimated to be \$148,500,000.

Financing for the project's physical facilities is expected to be obtained through the State Board for Financing Water Projects (Nevada Revised Statutes 349.935 to 349.961). Through a combination of hook-up fees and monthly water charges, water customers of the project would pay for the total costs of the project, including the financing of capital costs, annual operation and maintenance of facilities, monitoring, and depreciation expenses.

Annual operating costs would increase each year as water demand increases in Lemmon and Spanish Springs Valleys. Natural gas is expected to be the single largest operating expense at almost \$1,000,000 annually at full operation. By the time the pumping limit of 13,000 acre-ft/yr is reached, the total operating cost, which includes monitoring, is estimated at \$2,000,000 annually.

2.1.8 *Schedule*

The time required from the start of final design of the project to the initial delivery of water to customers in Lemmon and Spanish Springs Valleys is about 1.5 years. The sequence of construction steps is illustrated in Figure 2-7. If additional crews are used during construction, the water-delivery date could be moved up by several months.

2.2 *ALTERNATIVES*

Four alternatives to the proposed action are analyzed in this EIS. These include three alternative routes for the water and gas pipelines (Figure 2-8) and a no action alternative. Table 2-6 summarizes the acreage of land that would be disturbed during pipeline

construction along each alternative route and the proposed route. Figure 2-9 shows the length of the various segments of the proposed and alternative pipeline routes. The chief differences among the various pipeline configurations are total length, miles of public land affected, and the environmental sensitivity of the lands along the routes.

2.2.1 *Winnemucca Valley Alternative Route*

The Winnemucca Valley route would require 76.5 miles of trenching for the water and gas pipelines. By routing both pipelines through Winnemucca Valley, construction in Bedell Flat would be avoided.

The Winnemucca Valley route would traverse 29 miles of public land, which is equivalent to a disturbance of 357 acres. The route would follow existing dirt and gravel roads, except for short sections of the route west of the BLM's wild horse corral near Pyramid Lake Highway (Figure 2-8).

The water pipeline for the Winnemucca Valley route, similar to the proposed route, would require approximately 1,500 feet of lift in a horizontal distance of roughly seven miles from Honey Lake Valley to a 5,500-foot pass in the Virginia Mountains. The Winnemucca Valley route would diverge eastward from the proposed route on its ascent out of Honey Lake Valley (Figures 2-8 and 2-9). It would pass along the north side of Newcombe Lake (dry), cross several tributaries of Dry Valley Creek, and then descend and cross the main fork of Dry Valley Creek. From the creek, the route would ascend a low pass and then descend gradually into Winnemucca Valley. The route would follow an existing dirt road through Winnemucca Valley and intersect the route of the proposed water pipeline at the northern end of Hungry Ridge near Butler Spring. From this point, the Winnemucca Valley route would trend due west along the route of the proposed gas pipeline and intersect the proposed water pipeline route in northern Hungry Valley where it would travel southward toward Lemmon Valley. The water-storage tank site would be identical to the site in southern Hungry Valley for the proposed Bedell Flat route.

TABLE 2-5	
ESTIMATED COSTS OF THE TRUCKEE MEADOWS PROJECT	
Item	Estimated Costs
Pipelines	\$42,000,000
Pump Stations	5,000,000
Storage	2,500,000
Collection System	2,000,000
Power Facilities	16,000,000
Wells	1,500,000
Engineering	3,500,000
Contingency	10,000,000
Mitigation	<u>2,500,000</u>
Total Facilities	\$85,000,000
Water Rights	30,500,000
TOTAL PROJECT COSTS ^(a)	115,500,000
Annual operating and maintenance costs ^(b)	\$ 2,000,000
^(a) Financing costs, assuming annual payments at 6.5 percent interest for 30 years, would amount to \$148,500,000. ^(b) Based on a delivery rate of 13,000 acre-ft/yr. Includes fuel, disinfectant, environmental and hydrological monitoring, and labor.	
Source: Washoe County	

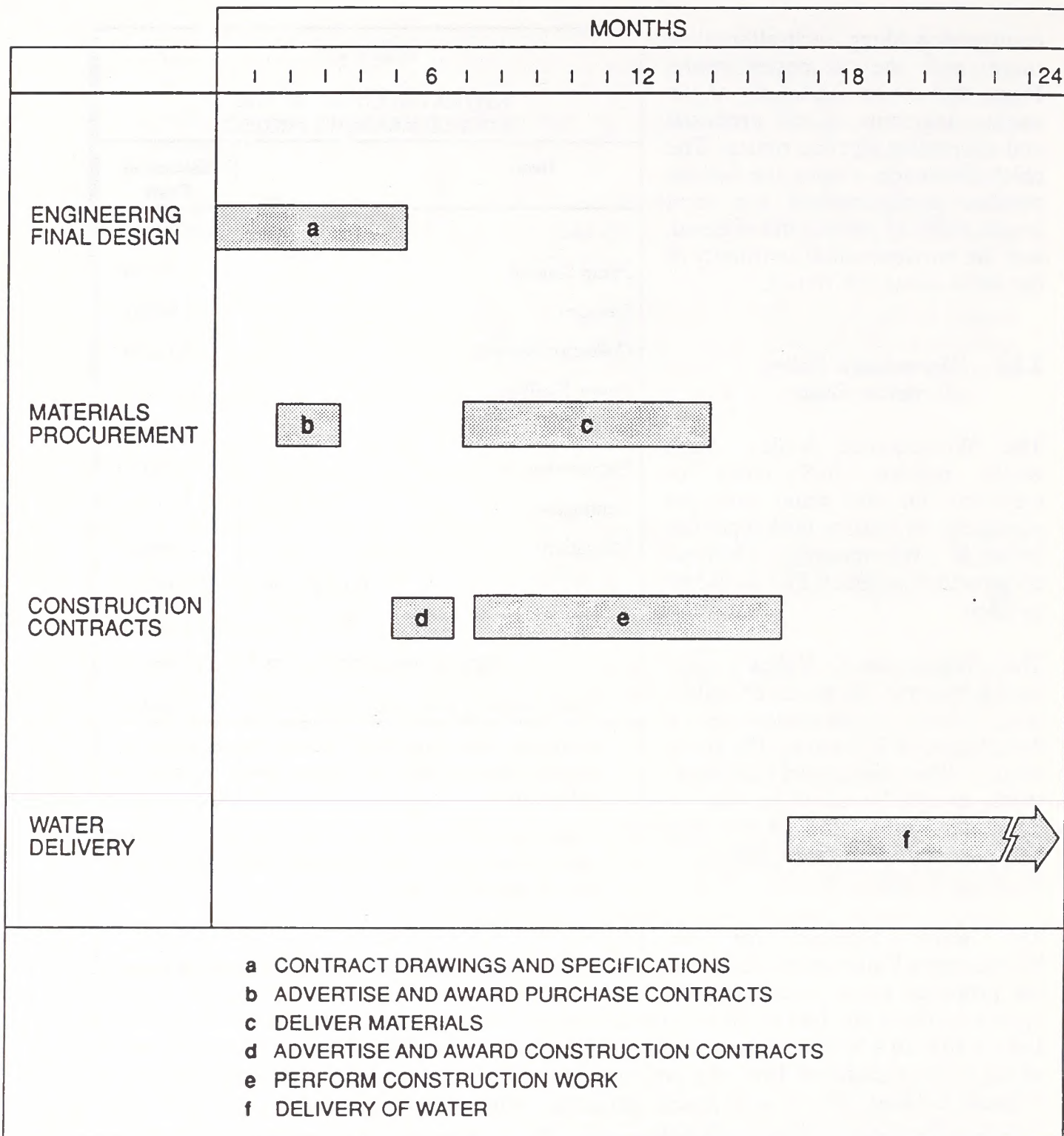


Figure 2-7
Schedule of Construction and Initial Water Deliveries.

TABLE 2-6

COMPARISON OF THE PROPOSED AND ALTERNATIVE PIPELINE ROUTES

Route Name	Total Route ^(a)		Right-of-Way on Public Land ^(b)		
	Length	Land Disturbance	Length	Land Disturbance ^(c)	Disturbance After Reclamation ^(d)
Bedell Flat	77.5 miles	940 acres	41 miles	502 acres	75 acres
Winnemucca Valley	76.5 miles	928 acres	29 miles	357 acres	54 acres
Antelope Valley	79.0 miles	959 acres	35.4 miles	435 acres	65 acres
Red Rock Valley	97.1 miles	1,179 acres	33 miles	406 acres	61 acres

^(a) Includes public and private lands. Where the water and gas pipelines are within the same 100-foot-wide right-of-way, the mileage has been counted once. The acreage listed includes areas within the 100-foot-wide disturbance where some dirt roads exist. Includes nine miles of pipeline in Honey Lake Valley that would connect the wells to the pumping station.

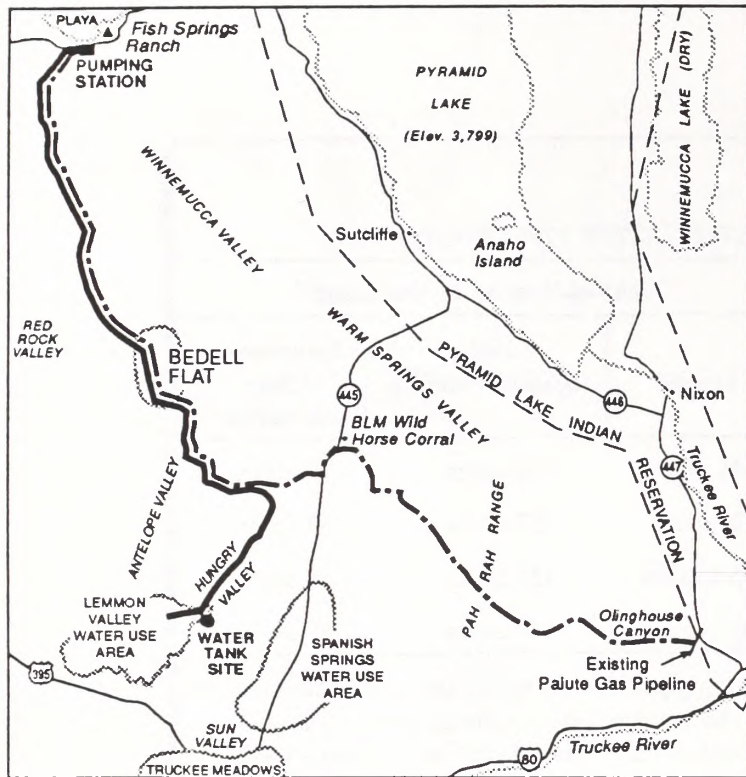
^(b) Public lands along the routes are not continuous; they are separated into numerous segments by private lands (see Figure 1-1). Includes 1.3 miles of public land in Honey Lake Valley that would connect the wells to the pumping station.

^(c) The acreage listed includes areas within each 100-foot-wide route that contain dirt roads approximately 15-foot wide. Also, the acreage listed includes an additional five acres for each route for use of, and access to, the terminal water-storage site at the south end of Hungry Valley.

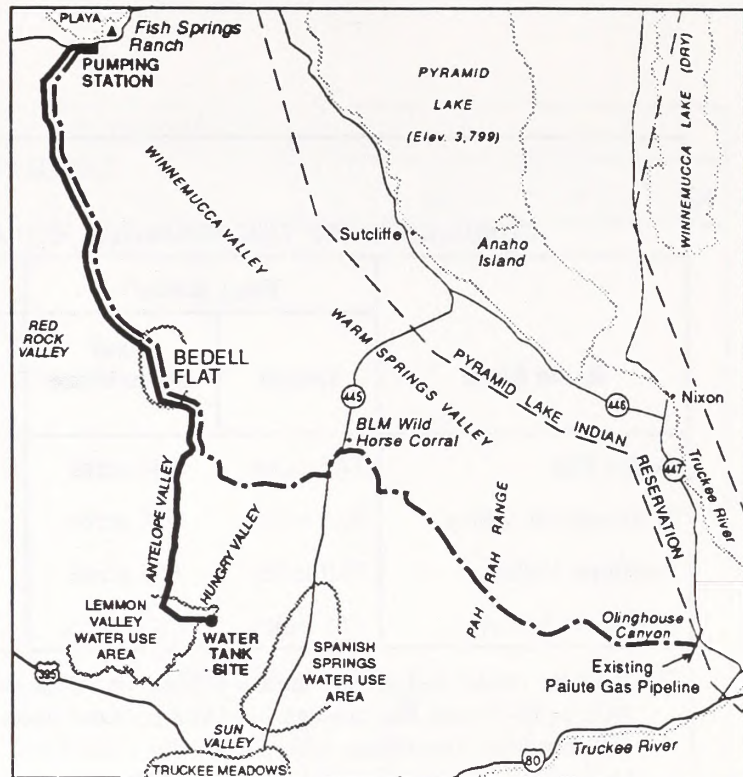
^(d) The acreage listed is the maximum number of acres that would not be reclaimed. It assumes that a 15-foot-wide access and maintenance road would be constructed within the 100-foot-wide route along any of the alternatives. Actually, Washoe County would only require roads within the rights-of-way where there are no nearby existing roads outside the rights-of-way.

The route of the gas pipeline for the Winnemucca Valley alternative would be identical to the proposed gas-pipeline route from Dodge Flat to northern Hungry Valley. From northern Hungry Valley, the gas pipeline would follow the route of the water pipeline through Winnemucca Valley, traverse the Virginia Mountains, and descend into Honey Lake Valley.

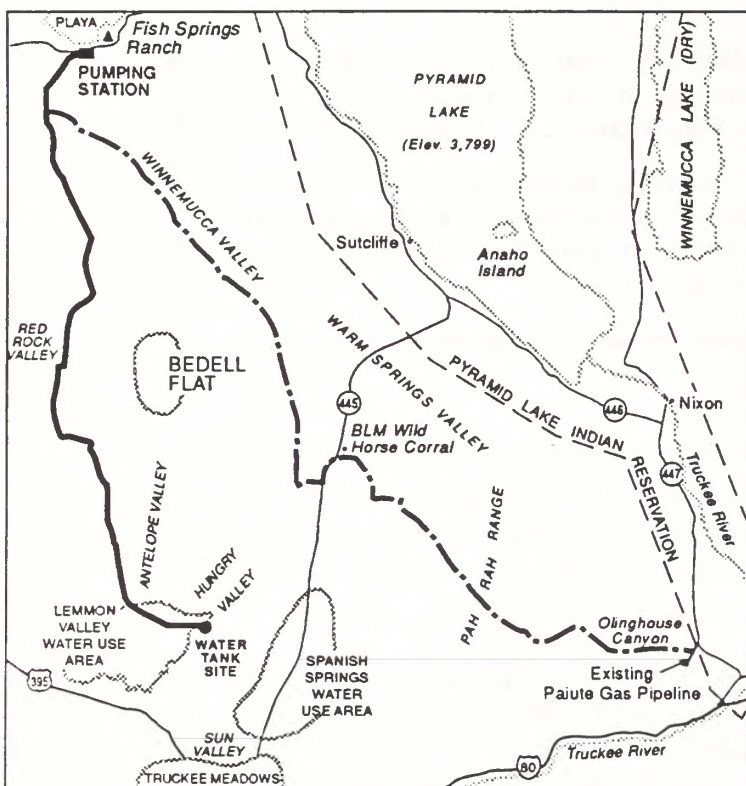
The total capital cost associated with this route alternative, including water rights and all facilities necessary to delivery the water to Lemmon and Spanish Springs Valleys, is estimated at \$90,000,000. This estimate was provided by Washoe County and it does not include financing. Operating costs, which includes monitoring, are estimated at \$2,000,000 annually by 2015.



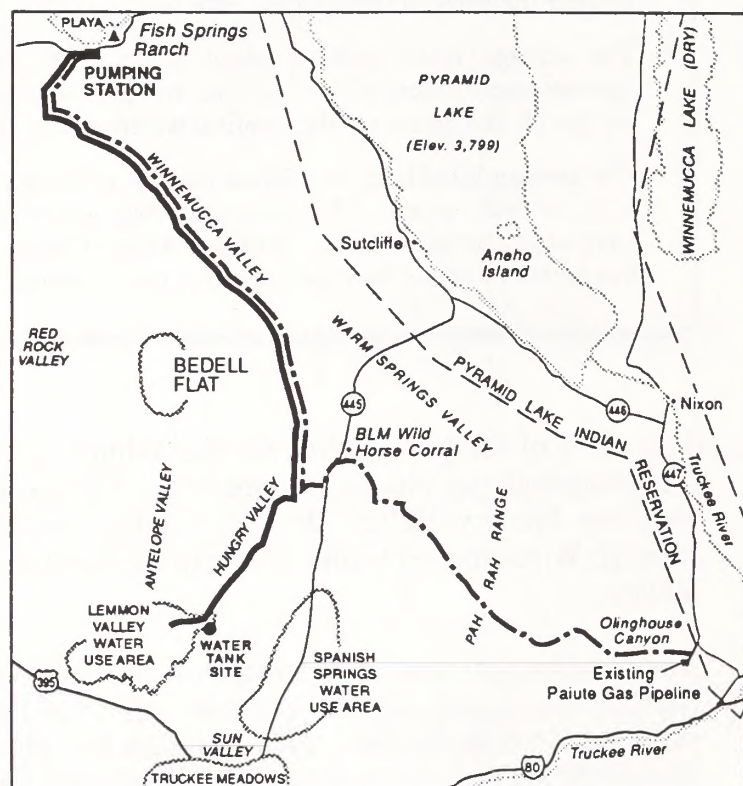
Proposed Bedell Flat Rights-of-Way



Antelope Valley Alternative



Red Rock Valley Alternative



Winnemucca Valley Alternative

LEGEND

- Water Pipeline
- Gas Pipeline

Figure 2-8

Proposed and Alternative Right-of-Way Routes



0 5
MILES

2.2.2 Antelope Valley Alternative Route

The Antelope Valley route would require 79 miles of trenching for the water and gas pipelines (Figure 2-8). The route would traverse 35.4 miles of public land which is equivalent to a disturbance of 435 acres.

The water pipeline for the Antelope Valley route would diverge from the proposed route in northern Antelope Valley where it would follow an existing dirt road southward through Antelope Valley between Freds Mountain and Hungry Mountain. It would ascend a low pass before descending into a residential area in Lemmon Valley. The water-storage tank site would be identical to the site in southern Hungry Valley for the proposed Bedell Flat route. The route of the gas pipeline is identical to the proposed route.

The total capital cost associated with this route alternative, including water rights and all facilities necessary to delivery the water to Lemmon and Spanish Springs Valleys, is estimated at \$87,000,000. This estimate was provided by Washoe County and it does not include financing. Operating costs, which includes monitoring, are estimated at \$2,000,000 annually by 2015.

2.2.3 Red Rock Valley Alternative Route

The Red Rock Valley route would require 97.1 miles of trenching for the water and gas pipelines. It is the longest pipeline route under consideration in this EIS and it would avoid construction in Bedell Flat (Figure 2-8). The route would traverse 33 miles of public land which is equivalent to a disturbance of 406 acres.

The route of the water pipeline would follow existing dirt and gravel roads from its point of divergence from the proposed route to its terminus in Lemmon Valley. It would diverge from the proposed water route at a low pass between Seven Lakes Mountain and the Sand Hills (north of Bedell Flat) and then trend southward through Red Rock Valley. The route would exit the valley through a narrow canyon that contains numerous springs and wetlands along a 1.5-mile stretch. After passing through the canyon, the Red Rock Valley route would travel easterly, cross a low pass in the southern Sand Hills, and descend for a short distance into the upper drainage basin of Bedell Flat. From this point, the Red Rock Valley route would cross a low pass, descend into the valley west of Freds Mountain, cross another low pass at the south end of Freds Mountain, and descend into Lemmon Valley. The water-storage tank site would be identical to the site in southern Hungry Valley for the proposed Bedell Flat route.

The route of the gas pipeline is identical to the route described under the Winnemucca Valley alternative (Figure 2-8).

The total capital cost associated with this route alternative, including water rights and all facilities necessary to delivery the water to Lemmon and Spanish Springs Valleys, is estimated at \$92,000,000. This estimate was provided by Washoe County and it does not include financing. Operating costs, which includes monitoring, are estimated at \$2,000,000 annually by 2015.

2.2.4 No Action Alternative

Under the no action alternative, the BLM would deny Washoe County's right-of-way applications. Although the Nevada State Engineer has already approved the export of water from Honey Lake Valley, BLM has not approved the rights-of-way needed to construct the pipelines to export that water.

If the no action alternative is selected, the BLM would have no authority to require the implementation of any of the other water management alternatives evaluated in this EIS. Nevertheless, the scoping process for this EIS identified water management alternatives to the *Truckee Meadows Project*, and regulations implemented by the Council of Environmental Quality allow for the analysis of alternatives outside the jurisdiction of the lead agency. Therefore, several water management alternatives are evaluated in this EIS.

If the no action alternative is selected and the proposed rights-of-way are denied, Washoe County as well as other water purveyors could develop other water supplies. The most comprehensive analysis of those supplies that is available to the public is contained in the Regional Water Resources Plan (Regional Water Planning and Advisory Board, 1990). The plan identifies many potential water supplies for the community, some of which are more promising than others. A comprehensive analysis of all the potential water-management proposals is available for public review in the Regional Water Resources Plan.

Three water management proposals are analyzed in this EIS under no action; these are *sub-alternatives* under the no action alternative. They are included in this document to provide decision-makers with information about potential environmental impacts if the no action alternative is selected, and to provide the public with information about various water management alternatives that other agencies could implement if the no action alternative is selected. Discussion of these sub-alternatives does not imply that the BLM has any jurisdiction over their implementation.

Parts or all of these sub-alternatives could be implemented simultaneously; they are not mutually exclusive. Furthermore, parts or all of these sub-alternatives could also be implemented in conjunction with the proposed action.

2.2.4.1 Supply Side Sub-Alternative

The supply side sub-alternative for this EIS combines the two most promising options in the short term that were identified in the Regional Water Resources Plan. According to the plan, an additional 3,000 acre-ft/yr of water could be supplied by increased pumping of groundwater in the Truckee Meadows. The plan also indicates that an additional 6,900 acre-ft/yr of water could be supplied by acquiring Truckee River irrigation water rights. The total additional water available from the supply side sub-alternative would be 9,900 acre-ft/yr. This water would be available to the entire Reno-Sparks metropolitan area (including Lemmon and Spanish Springs Valleys), so long as all return-flow requirements of the Truckee River are met.

The total project cost for the supply side sub-alternative, including the acquisition of water rights, is estimated to be \$51,200,000 (estimate provided by Washoe County). This includes

\$29,700,000 for acquisition of surface water rights, \$16,000,000 for facilities to meet drinking water standards, \$1,000,000 for development of four wells, and \$4,500,000 for acquisition of groundwater rights. Financing costs would be additional. No estimate of financing costs is currently available.

2.2.4.2 Demand Side Sub-Alternative

The demand side sub-alternative consists of water conservation measures. A variety of measures, some on-going, were identified in the Regional Water Resources Plan. These measures affect the total water resources available to the region by reducing the future amount used by both the water utility and by individual customers. Measures considered in the plan include water management practices that reduce future demand through reductions of water use, water waste, and system losses, and which have been proven in other communities to be acceptable and cost effective. A number of water purveyors, local governments, and other groups promote water conservation throughout the community.

The water conservation measures identified in the plan are intended to reduce the dedication of water resources for water-service applicants. The conserved water could then be used for a variety of options, including municipal and industrial water use.

The water conservation programs identified in the plan were based on Water-Plan, a computer program developed for the California Department of Water Resources. Selected measures include ultra-low-flush toilets, efficient dishwashers, xeriscaping for residential and commercial uses, automatic shutoff faucets, audits of development plans, faucet aerators, and commercial ultra-low-flow showerheads. Many of these measures are currently being implemented in the Reno-Sparks metropolitan area. An aggressive water conservation plan employing these measures for new growth could result in an estimated decrease in dedication of water resources of 6,800 acre-feet during the next 20 years. In addition, the on-going program to install water meters in new residential construction is estimated to reduce future demand by 2,000 acre-feet over a 20 year period. Total reduction of future water demand would amount to 8,800 acre-feet or 116 gallons per day per new housing unit.

Because this sub-alternative is based on reductions of future demand through implementation of aggressive water conservation measures for new construction, it is not a stand-alone alternative. Instead, the water savings associated with the demand side sub-alternative are dependent on the development of a new 40,000 acre-foot water supply to accommodate projected growth.

The Regional Water Resources Plan estimates the cost of implementing aggressive water conservation measures in new construction at \$11,600,000. Installation of water meters in new construction is estimated to add another \$24,500,000 based on a per meter cost of \$430 for 57,000 houses (estimate provided by Washoe County). Financing costs would be additional. No estimate of financing costs is currently available. The costs for developing a new supply of water associated with these water savings are not included in the analyses of this sub-alternative.

2.2.4.3 *Negotiated Settlement Sub-Alternative*

Public Law 101-618 ("Negotiated Settlement Act") provides a mechanism for carrying out the terms of a *preliminary settlement agreement* between Westpac Utilities and the Pyramid Lake Paiute Tribe for use of water originating in the Truckee River basin. The law requires, among other things, that an EIS be prepared by the U.S. Bureau of Reclamation and the U.S. Fish and Wildlife Service on negotiations to modify the existing operation of Truckee River system which is currently mandated by law and agreement. Implementation of the Act involves 72 separate actions including agreements, reports and studies, court actions, water rights acquisitions or change programs, and water appropriations.

A general analysis of the negotiated settlement is contained in this EIS. It considers the preliminary nature of the settlement process and the fact that a separate EIS on the negotiated settlement is currently being prepared for this action. Nevertheless, the general framework of the negotiated settlement, as outlined in the Regional Water Resource Plan, is available and will be analyzed in this EIS to the extent feasible. According to that plan, the negotiated settlement could involve a variety of supply and demand measures, including acquisition of additional upstream storage and imposition of water conservation measures. The plan concluded that the settlement could yield 39,000 acre-ft/yr of water. This water would be available throughout the Reno-Sparks metropolitan area, including Lemmon and Spanish Springs Valleys. See Public Law 101-618 for a detailed description of the provisions of the negotiated settlement.

Due to the preliminary nature of the negotiated settlement, no reliable cost estimates are currently available for implementing the settlement.

2.3 *ALTERNATIVES CONSIDERED, BUT ELIMINATED FROM DETAILED ANALYSIS*

2.3.1 *Pyramid Lake Route*

The alternative of routing the water and gas pipelines through the Pyramid Lake Indian Reservation was eliminated from detailed analysis due to cost. The water pipeline would be 24 miles longer than the longest route under consideration in this EIS.

2.3.2 *Growth Limits Alternative*

Several comments received during the scoping process stated that growth limits should be considered as an alternative to the *Truckee Meadows Project*. Since the 1970s, a moratorium on new subdivisions has been in effect in Lemmon Valley due to limited supplies of water. A reliable source of water is also a major concern for planned growth in Spanish Springs Valley. The purpose of the *Truckee Meadows Project* is to provide water to those valleys so that forecasted growth can occur, as identified by Washoe County (1991a; 1991b). A growth-limitation alternative does not satisfy the purpose of providing water to meet planned growth. It is therefore not an alternative means to meet the objectives of the proposed action, and it is not analyzed further in this EIS.

2.3.3 *Alternative Water Supplies*

All of the alternative water supplies described by the Regional Water Planning and Advisory Board (1990), except those included as alternatives in this EIS, have been eliminated from detailed analysis. The reasons for their elimination are due to a combination of their uncertainty, cost, or limited yield. See the *Regional Water Resource Plan* for additional information about these alternatives (Regional Water Planning and Advisory Board, 1990).

2.3.3.1 *Silver State Project*

The *Silver State Project*, also known as the Washoe County Groundwater Importation Project, was commissioned by the Regional Water Planning and Advisory Board in 1987 to investigate the export of groundwater from several valleys in northern Washoe County for use in the Truckee Meadows area. As envisioned, the 50-year project would ultimately include 372 miles of buried water pipelines and 42 production wells. At the end of 50 years, the project was estimated to have a yield of more than 50,000 acre-ft/yr. To acquire the water, Washoe County has filed applications with the State Engineer for all unappropriated waters in numerous basins in northern Washoe County.

Since release of the initial reconnaissance study of the *Silver State Project* in 1987 (Beck and Associates, 1987), the cities of Reno and Sparks and Washoe County, with the approval of the State legislature, have designated Washoe County to act as the Regional Water Resource Management Agency to coordinate and manage water-related responsibilities. According to recent correspondence from the Washoe County Commission addressed to the BLM, the county does not intend to pursue the *Silver State Project* in the foreseeable future because of other water-resource developments that are now occurring in the metropolitan area, and because of the incomplete status of the original report by Beck and Associates (1987). Therefore, the *Silver State Project* is not analyzed in this EIS.

2.3.3.2 *EcoVision*

EcoVision is a recent proposal by private parties to pump approximately 280,000 acre-ft/yr of groundwater from northeast Nevada and transport the water via the Humboldt River and pipelines to wetlands and cities in west-central Nevada. Because of the many uncertainties associated with this project, it is premature to analyze EcoVision in this EIS.

2.4 ***SUMMARY AND COMPARISON OF ENVIRONMENTAL EFFECTS OF THE PROPOSED ACTION AND ITS ALTERNATIVES***

Table 2-7 summarizes and compares the direct and indirect environmental consequences of granting the proposed or alternative rights-of-way to Washoe County.

TABLE 2-7

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND ITS ALTERNATIVES

Affected Resources	Bedell Flat Proposed Action	Winnemucca Valley Alternative	Antelope Valley Alternative	Red Rock Valley Alternative	No Action Alternative		
					Supply Side Sub-Alternative	Demand Side Sub-Alternative	Negotiated Settlement Sub-Alternative
WATER SUPPLY: (acre-ft/yr)	13,000	13,000	13,000	13,000	9,900	0	39,000
SOILS: (acres disturbed) ^(a)	9,840	9,830	9,860	10,080	4,300	0	16,300
AIR QUALITY:							
1. Carbon Monoxide (kg/day) ^(b)	2,580	2,580	2,580	2,580	2,620	0	10,700
2. Particulate Matter							
• Truckee Meadows Nonattainment Area (kg/day)	1,300	1,300	1,300	1,300	1,440	0	5,900
• Honey Lake Valley (μ g/m ³)	14.4	14.4	14.4	14.4	0	0	0
3. Ozone ^(c)							
• Hydrocarbons (kg/day)	1,600	1,600	1,600	1,600	850	0	3,410
• Nitrogen Oxides (kg/day)	2,260	2,600	2,600	2,600	1,240	0	4,880
SURFACE WATER:							
• Dry Washes Crossed by Pipelines	80	66	80	89	0	0	0
• Creek Segments Crossed by Pipelines	8	7	8	9	0	0	0
GROUNDWATER FLOW AND QUANTITY:							
1. Drawdown of Water Table (in feet): ^(d)							
• Honey Lake Valley along California Border ^(e)	20-25	20-25	20-25	20-25	0	0	0
• Astor Pass	50-55	50-55	50-55	50-55	0	0	0
• Sand Pass	35	35	35	35	0	0	0
• Sierra Army Depot	<5	<5	<5	<5	0	0	0
2. Groundwater Flow to Smoke Creek Desert from Honey Lake Valley (in acre-ft/yr)	3,040	3,040	3,040	3,040	5,300	5,300	5,300
GROUNDWATER QUALITY AT WELL FIELD: (in % change, in "+" or "-", from 1988 TDS values)	+15	+15	+15	+15	0	0	0
(Continued next page)							

TABLE 2-7

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND ITS ALTERNATIVES

Affected Resources	Bedell Flat Proposed Action	Winnemucca Valley Alternative	Antelope Valley Alternative	Red Rock Valley Alternative	No Action Alternative		
					Supply Side Sub- Alternative	Demand Side Sub- Alternative	Negotiated Settlement Sub- Alternative
SUBSIDENCE IN HONEY LAKE VALLEY: (in inches) ^(c)							
• Eastern Honey Lake Valley	16-108	16-108	16-108	16-108	0	0	0
• Sierra Army Depot	<5	<5	<5	<5	0	0	0
WETLANDS: (acres potentially affected) ^(d)	59-286	63-290	59-286	72-299	unknown	0	unknown
VEGETATION: (acres affected) ^(b)	45,540	45,530	45,560	45,780	4,300	0	16,300
WILDLIFE: (disturbance in acres) ^(b)							
• Critical/Crucial Deer Range	0	0	0	40	unknown	0	unknown
• Summer/Winter Deer Range	100	135	100	100	unknown	0	unknown
• Pronghorn Use Areas	340	240	290	340	0	0	0
• Sagegrouse Use Areas	90	60	90	120	0	0	0
• Mountain Quail Habitat (Candidate Species)	35	35	35	35	0	0	0
CULTURAL RESOURCES: (number of significant prehistoric/historic sites affected)	2/7	4/7	2/7	4/7	unknown	0	unknown
LAND USE: (in acres disturbed for growth throughout Reno-Sparks metropolitan area from 1995-2015; includes Lemmon and Spanish Springs Valleys)	8,900	8,900	8,900	8,900	4,300	0	16,300
SOCIOECONOMICS:							
• Project cost (in millions) ⁽ⁱ⁾	\$115.5	\$120.5	\$117.5	\$122.5	\$51	\$36.1	Not Available
• Population increase in Lemmon and Spanish Springs Valleys (1995-2015)	46,500	46,500	46,500	46,500	12,700	0	46,500
• Population increase in the Truckee Meadows (1995-2015)	0	0	0	0	22,700	0	92,800
• Increase in daily vehicle miles travelled by 2015 in Truckee Meadows, Lemmon Valley, and Spanish Springs Valley (in millions of miles) ^(j)	1.42	1.42	1.42	1.42	0.78	0	3.08

(Continued next page)

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TABLE S-1

SUMMARY AND COMPARISON OF IMPACTS FROM THE PROPOSED ACTION AND ITS ALTERNATIVES

(a)	Includes direct impacts along pipeline routes and indirect impacts in the Reno-Sparks metropolitan area.
(b)	For Truckee Meadows nonattainment area only.
(c)	Includes emissions in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows.
(d)	Maximum drawdown of the water table is projected by computer modeling to occur about 100 years after pumping begins.
(e)	This is the maximum predicted drawdown along the Nevada-California state line west of Fish Springs Ranch. Drawdown elsewhere along the border is projected to be less.
(f)	Maximum subsidence would take several hundred years to occur.
(g)	Includes the combined acreage of direct and indirect impacts along the pipeline routes and in the water source area.
(h)	Includes the combined acreage of direct and indirect impacts along the pipeline routes, in the water source area, and in the delivery/use area.
(i)	Includes costs for facilities and the acquisition of water rights; financing costs are not included.
(j)	The increase in vehicle miles travelled is a quality of life indicator of potential traffic congestion in the Reno-Sparks metropolitan area in 2015.

3.0 AFFECTED ENVIRONMENT

This chapter characterizes the physical, biological, and socioeconomic environments that could be affected by pipeline construction and operation along either the proposed or alternative rights-of-way. Also characterized are the areas that would be affected by groundwater pumping, as well as the areas that would be affected by the use of this groundwater.

The resource descriptions in this chapter and in Chapter 4 (land use, wildlife, soils, etc.) are focused on the *pipeline routes*, the *water source area*, and the *delivery/use area* (Figure 3-1). The area referred to as the *pipeline routes* on Figure 3-1 includes the proposed Bedell Flat route, and the three alternative routes depicted on Figure 2-8. The *water source area* coincides with the area of projected drawdown of the water table from planned groundwater pumping at Fish Springs Ranch. The *delivery/use area* includes Lemmon and Spanish Springs Valleys.

Operation of the *Truckee Meadows Project* would have effects beyond the three geographic areas shown on Figure 3-1. The Truckee Meadows would be affected, as would Pyramid Lake, the Truckee River, and Honey Lake. The area on Figure 3-1 encompassing the *pipeline routes*, the *water source area*, the *delivery/use area*, as well as the Truckee Meadows, the Truckee River, Pyramid Lake, and Honey Lake is referred to as the *affected area*.

For the convenience of the reader, a fold-out map of the proposed and alternative pipeline routes is contained at the end of this document. Note that the alternative pipeline routes include segments of the proposed routes as well as segments of the other alternative routes.

3.1 SOILS

The soils data used in this section were developed by the U.S. Soil Conservation Service (SCS, 1983). Additional unpublished Order III soil-survey data, as well as information on prime and unique farmlands, were obtained from the SCS field office in Reno, Nevada (SCS, no date).

3.1.1 Pipeline Routes

- *Proposed Routes*

The reclamation potential of the soils along the proposed rights-of-way in Honey Lake Valley is variable, but generally only fair to poor. These soils are highly saline, composed mostly of fine silt with smaller amounts of sand. The erosion susceptibility described below for each pipeline segment is for *disturbed* soils.

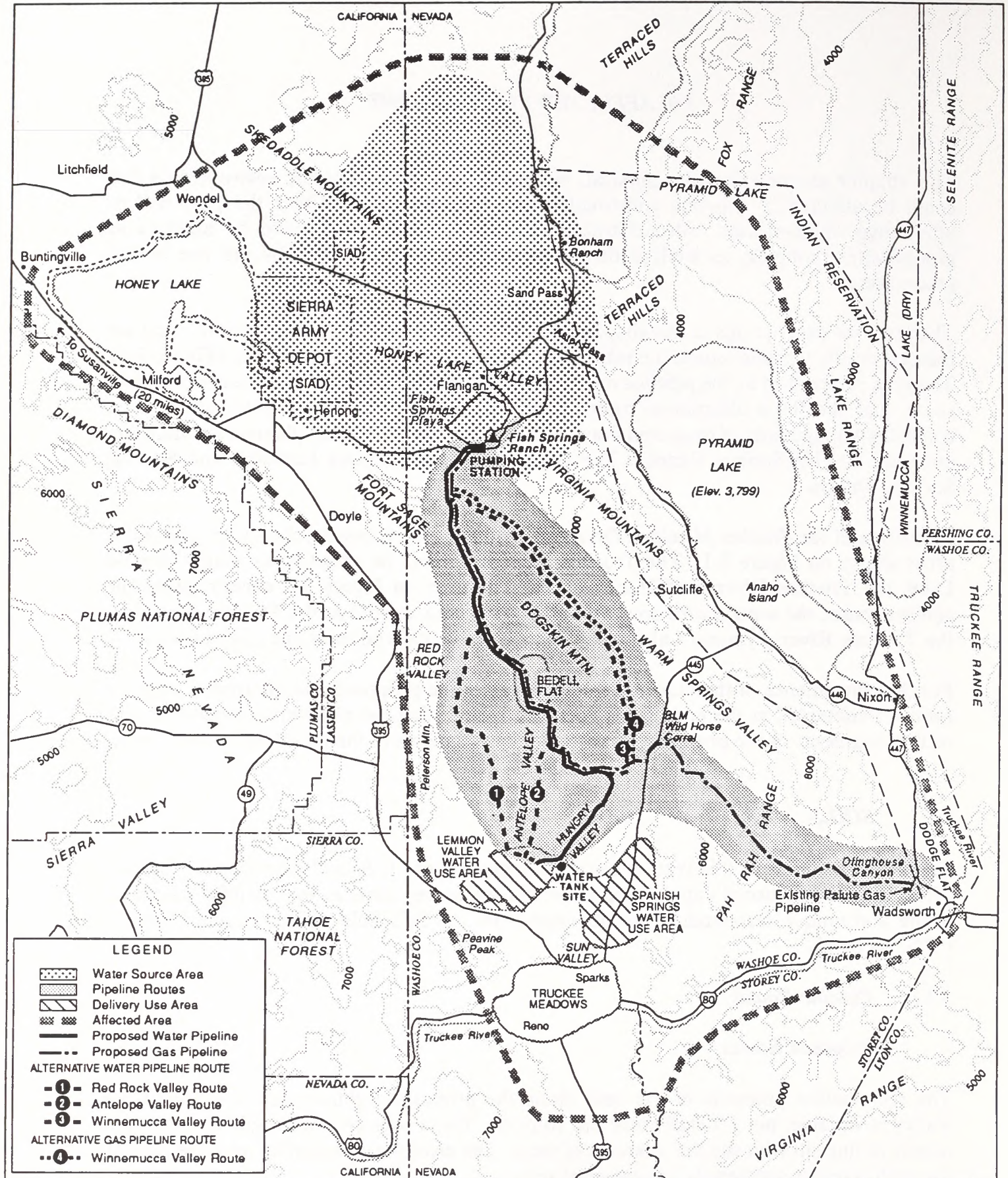
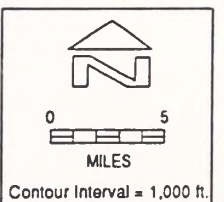


Figure 3-1

Geographic Areas Discussed in Text



Proposed 29-Mile Segment from the Well Field in Honey Lake Valley to Northern Hungry Valley

Almost half of this proposed segment is characterized by soils that are 60 or more inches deep. These soils include the Haybourne, Leviathan, Lemm, Surprise, Wedertz, Galeppi, Incy, Bedell, Springmeyer, Jowec, and Aladshi series. Some of the soils have a high percentage of stones and cobbles in their profiles. Only the Jowec soils have silty-clay to silty-clay-loam surface textures, whereas the other soils are sandy loams or loamy sands throughout.

More than 10 miles of this segment is characterized by soils less than 20 inches deep that cover weathered or unweathered bedrock or hardpan. These soils include the Terca, Acrelane, Devada, Chalco, and Luppino series.

About seven miles of this segment has soils from 20 to 40 inches deep that cover bedrock and hardpan. The major soils include the Indiano, Arzo, Aquinas, Barnard, and Verdico series.

The reclamation potential of soils along this segment is only fair due to stoniness and slope. The erosion potential from wind and water is moderate to severe. There are no prime or unique farmlands.

Proposed 10-Mile Segment from Northern Hungry Valley to Lemmon Valley

Soils along this segment are mostly on level slopes, deep to very deep, with sandy textures. These soils are not salty, their profiles are mostly free of stoniness with few restrictions, and their reclamation potential is good. There are no irrigated soils or prime and unique farmlands along this segment. Soils at the southern end of this segment are moderately to highly susceptible to wind and water erosion; soils at the north end are less susceptible.

Proposed 29.5-Mile Segment from Northern Hungry Valley to Dodge Flat

Soils along the lowland parts of this segment are mostly sandy textured, gravelly or stony, deep to very deep, and occur on level slopes. The reclamation potential of these soils is fair.

Soils in the Pah Rah Range can occur on steep to very steep slopes. These soils are rocky, stony and cobbly, mostly sandy-loam textured, and shallow to moderately deep; they are moderately to highly susceptible to wind and water erosion when disturbed. The reclamation potential of these soils is poor due to steepness, stoniness, and shallow soil profiles. No prime and unique farmlands occur along this segment, but there are irrigated soils in Warm Springs Valley.

- *Winnemucca Valley Alternative Route*

The Winnemucca Valley route crosses alluvial fans, terraces, and other landscapes that are very similar to the proposed route from Honey Lake Valley to northern Hungry Valley. Near its northern end, the Winnemucca Valley route crosses floodplains and low terraces

for a five-mile stretch that is typified by the Mellor-Updike-Godecke Association. These soils are nearly level, very deep, somewhat poorly drained to moderately well-drained, with seasonally high water tables, and low to moderate salt and alkali content. Reclamation potential of these soils is only fair due to their salinity. Erosion potential from wind and water is moderate. No prime and unique farmlands occur along this segment, but there are irrigated soils in Winnemucca Valley.

- *Antelope Valley Alternative Route*

This route traverses soils that are very similar to the soils along the proposed route from northern Hungry Valley to Lemmon Valley. The reclamation potential of these soils is fair to good. Erosion potential by wind and water is moderate to severe. Neither irrigated soils nor prime and unique farmlands occur along this route.

- *Red Rock Valley Alternative Route*

Soils along this route are very similar to the soils along the Winnemucca Valley route. Five miles of floodplains and low terraces are traversed by this route. Soils have fair reclamation potential due to their low to moderate salt and alkali content. Erosion potential by wind and water is slight. No prime or unique farmlands occur along this segment, but there are irrigated soils in Red Rock Valley.

3.1.2 *Water Source Area*

- *Honey Lake Valley and Vicinity*

Honey Lake Valley contains very deep, level to moderately sloping, saline-affected soils on playas, alluvial floors, sand dunes, and lake-plain terraces. These soils have a loam, silt-loam, or silty-clay-loam texture. Saline or white alkali soils have developed in parts of Honey Lake Valley due to low rainfall, a high water table, and high evapotranspiration. Neutral soluble salts including sodium, calcium, and magnesium, accumulate in the surface horizons in concentrations sometimes sufficient to interfere with the growth of plants. The playa of Honey Lake has silty clay and clay soils, with 35-70 percent clay content. These soils have very slow permeability of 0-0.06 inches per hour, and high shrink-swell potential. They have high salinity and are not capable of supporting plant growth.

Soils in Honey Lake Valley are moderately susceptible to water erosion, but are only slightly susceptible to wind erosion. Water infiltrates slowly. In periods of drought, sediment deposited by flowing water is free to erode by wind erosion. Some areas with coarse soils also occur along the margins of the valley, which are susceptible to wind erosion.

Bottomland soils are characterized by loamy to silty-clay-loam surface textures. They are only slightly permeable and have a high water-holding capacity. They are strongly alkaline, and may have soil-moisture levels in their lower profiles at four to eight feet during part of the year. These characteristics support extensive stands of phreatophytic vegetation such as black greasewood, rabbitbrush, and saltgrass.

Dust from wind storms originating in Honey Lake Valley has, on occasion, substantially reduced visibility in the Reno-Sparks area. The chief source of this dust is the dry bed of Honey Lake in western Honey Lake Valley. The surface area of the lake can fluctuate widely from spring to late fall and winter and it has dried up almost a dozen times since 1859 (Rockwell, 1990). During the past six years of drought, Honey Lake has been dry for extended periods of time and the lake bed has been very susceptible to wind erosion.

At higher elevations in the water source area, shallow to deep soils have developed on alluvial fans, hills, and low plateaus. These upland soils are generally medium to coarse textured, and poorly drained to moderately well-drained. They are low in salinity and neutral in pH. Most are susceptible to water erosion, but only slightly susceptible to wind erosion.

On the California side of Honey Lake Valley, conditions that can support phreatophytes occur in a few soil units. The water table in these units usually varies between five to ten feet below the surface from January to April. The Ardep series has a water table usually eight to 12 feet below the surface lasting into early summer. In contrast, major soils on the Nevada side of the water source area have water-table levels that vary from only five to nine feet during the same time period. The exception is the Umler series which can have a three- to five-foot-deep water table for part of the year.

- *Sierra Army Depot*

Five sites at the Sierra Army Depot have been investigated for water and soil contamination (Sierra Army Depot, 1991). At an abandoned landfill, low levels of heptachlor and trichlorethylene (TCE) were discovered in several trenches. An open trench contained pesticides and volatile organic compounds (VOC) five feet below the bottom of the trench; traces of TCE were detected in soils near the water table which probably originated from this trench. At another site, explosive compounds and VOC were detected in the top 2.5 feet of soils. The most common explosive contaminant was 1, 3, 5-TNB. Modeling conducted by the Depot has shown that these compounds are essentially immobile (Sierra Army Depot, 1991). Public access to these sites is restricted by the Depot.

- *Smoke Creek Desert*

Soils in the Smoke Creek Desert tend to be fine-textured, with salt and alkali contamination near the surface. Many areas have a fluctuating water table, with a seasonally high water table in some years. These soils are only slightly susceptible to water and wind erosion. Reclamation potential is fair to poor due to texture and alkali/salt contamination.

At the southern end of the Smoke Creek Desert, 2,480 acres of land on the Pyramid Lake Reservation have been identified as potentially irrigable (Stetson Engineers, Inc., 1990). These lands extend in an approximate mile-wide, east-to-west band about a half-mile south of the playa. The irrigable soils include the Zorovista-Swinger and the Zoravista-Davey Series.

3.1.3 *Delivery/Use Area*

Soils in Lemmon and Spanish Springs Valleys are nearly level and very deep. They occur on low terraces and low-lying alluvial fans, and are poorly drained to moderately well-drained. The reclamation potential of these soils is fair to good.

The soils in the playa in Lemmon Valley are fine textured, containing 35-70 percent clay. Permeability is less than 0.1 inches per hour. The high salinity of these soils prevents plant growth.

3.2 *AIR QUALITY*

3.2.1 *Climate*

The affected area is east of the Sierra Nevada at elevations ranging from about 3,800 feet at Pyramid Lake to almost 9,000 feet in the Virginia Mountains. The area lies within the rain shadow of the Sierra Nevada and is classified as having a semi-arid climate (NOAA, 1991; Houghton et al., 1975).

There are two monitoring stations that have collected weather data in the region. The National Weather Service has a station at the Reno airport, from which data are available since before the turn of the century. The second station, located at Sand Pass between Honey Lake Valley and the Smoke Creek Desert, collected precipitation data from 1928 to 1971 (Western Regional Climate Center, 1992).

Annual average precipitation at Reno is 7.6 inches (NOAA, 1991). Over the last thirty years, 55 percent of the annual precipitation has fallen during the four-month period from December to March. Annual precipitation has varied between 3.3 and 13.2 inches.

The precipitation data from the Sand Pass station were compared with the data from the weather station in Reno. The amounts and patterns of precipitation were similar at the two stations. Consequently, it was concluded that the precipitation data collected at the weather station at Reno is representative of both the water source and delivery areas.

Temperatures in the area vary considerably from season to season and with elevation. Average maximum and minimum temperatures in Reno in July (the warmest month) are 91 and 48°F. Average maximum and minimum temperatures in January (the coldest month) are 45° and 20°F.

3.2.2 *Current Air Quality Status*

EPA classifies the air quality of an area by determining whether it meets the national ambient air quality standards, which are ambient concentrations of six pollutants: particulate matter less than 10 microns in size (referred to as dust, PM₁₀, or respirable particulates), ozone (O₃), nitrogen oxides (NO_x), sulfur dioxide (SO₂), carbon monoxide

(CO), and lead. As shown in Table 3.2-1, there are both primary and secondary standards. Primary standards are set at levels to prevent adverse effects on human health; secondary standards are set at levels to prevent adverse effects on vegetation, property, or other elements of the environment. Table 3.2-1 shows the Nevada state standards, which are identical to the national air quality standards for all pollutants except hydrogen sulfide and visibility, for which no federal standards exist.

If an area meets the primary standards for a particular pollutant, it is designated as being in *attainment*. Conversely, an area that does not meet the primary national air quality standards is designated as *nonattainment* for that particular pollutant. If insufficient information is available to designate an area as either attainment or nonattainment, it is designated as *unclassified*; this classification is often assigned to remote areas far from metropolitan centers.

The Clean Air Act places most of the responsibility on the states to achieve compliance with national air quality standards. The primary mechanism to achieve compliance is through State Implementation Plans (SIP). These plans must demonstrate the ability to achieve attainment for each regulated pollutant by a federally-specified deadline. The plans must also identify strategies to control pollutant emissions.

The Air Quality Management Division of the Washoe County District Health Department has the responsibility and authority for air quality in Washoe County. In November 1991, the Division submitted a SIP to the Environmental Protection Agency (EPA) to control particulate matter in the Truckee Meadows. In November 1992, Washoe County submitted SIPs to the EPA to address the other nonattainment pollutants: carbon monoxide in the Truckee Meadows and ozone for all of Washoe County.

3.2.2.1 Pipeline Routes and Water Source Area

The pipeline routes and the water source area are in attainment/unclassified with respect to all national air quality standards, with the exception of ozone. Because of the regional nature of ozone pollution, EPA policy is to include the entire metropolitan statistical area in the ozone nonattainment area. All of Washoe County is considered part of the statistical area, so the pipeline routes and Honey Lake Valley are included in the ozone nonattainment area.

Ozone is a more difficult pollutant to evaluate than the other pollutants because it is a *secondary* pollutant. That is, emission sources such as automobiles release nitrogen oxides and hydrocarbons, which then react in the presence of sunlight to form ozone. Therefore, the control of ozone is focused on the control of emissions of nitrogen oxides and hydrocarbons. Due to the sparse population and minor human activity along the pipeline routes and in the water source area, emissions of nitrogen oxides and hydrocarbons are minimal.

Dust originating in Honey Lake Valley during high winds has, on occasion, substantially reduced visibility in the Reno-Sparks area. The chief source of this dust is the dry bed of

TABLE 3.2-1

FEDERAL AND STATE AMBIENT AIR QUALITY STANDARDS

Pollutant	Averaging Period	Nevada State Standard	Federal Standards	
			Primary Standard	Secondary Standard
Particulate ^(a) Matter (PM ₁₀) ^(b)	Annual Arithmetic Mean	50 µg/m ³	50 µg/m ³	50 µg/m ³
	24-hr	150 µg/m ³	150 µg/m ³	150 µg/m ³
Ozone (O ₃)	1-hr	0.12 ppm	0.12 ppm	0.12 ppm
		235 µg/m ³	235 µg/m ³	235 µg/m ³
Nitrogen Oxides (NO _x)	Annual Arithmetic Mean	100 µg/m ³	100 µg/m ³	100 µg/m ³
		0.053 ppm	0.053 ppm	0.053 ppm
Sulfur Dioxide (SO ₂)	Annual Arithmetic Mean	80 µg/m ³	80 µg/m ³	-
		0.03 ppm	0.03 ppm	
	24-hr	365 µg/m ³	365 µg/m ³	-
		0.14 ppm	0.14 ppm	
Carbon Monoxide (CO)	8-hr	1300 µg/m ³	-	1300 µg/m ³
		0.50 ppm		0.5 ppm
	1-hr	10,000 µg/m ³	10,000 µg/m ³	10,000 µg/m ³
		9 ppm	9 ppm	9 ppm
Lead	Quarterly Arithmetic Mean	40,000 µg/m ³	40,000 µg/m ³	40,000 µg/m ³
		35 ppm	35 ppm	35 ppm
Hydrogen Sulfide	1-hr	1.5 µg/m ³	1.5 µg/m ³	1.5 µg/m ³
		0.08 ppm	N/A	N/A
Visibility	N/A	To maintain the prevailing visibility of greater than 30 miles	N/A	N/A
^(a) µg/m ³ = micrograms per cubic meter				
^(b) Particles less than 10 microns in size				

Honey Lake in western Honey Lake Valley (Figure 3-1). The surface area of Honey Lake fluctuates seasonally. The lake is fullest in the spring and lowest in late fall and winter. It has dried up completely almost a dozen times since 1859 (Rockwell, 1990). During the past six to seven years of drought, Honey Lake has been dry for extended periods of time and the lake bed has been very susceptible to wind erosion. Data are not available to quantify the extent or frequency of these dust storms, but a reasonable estimate is a few times per year during dry years.

No baseline air-quality measurements are available for Honey Lake Valley. Current air quality conditions in the valley are therefore unknown. PM₁₀ data are available, however,

from an area with a similar climate and population which can be used to help estimate *reasonable* baseline PM_{10} conditions in Honey Lake Valley. The Great Basin Unified Air Pollution Control District (GBUAPCD) in California has collected PM_{10} data for several years in Mono Lake Basin, California, located 170 miles southeast of Honey Lake Valley (GBUAPCD, 1993). Both areas are semi-arid with sparse vegetative cover. The Mono Lake Basin is a few thousand feet higher than Honey Lake Valley. There is a lake in each valley that shrinks during dry seasons and dry years, exposing bare lakebed to the wind and increasing the potential for dust storms.

One PM_{10} monitoring station is located at Lee Vining one to two miles southwest and upwind of Mono Lake. Between 1989 and 1992, the annual average PM_{10} concentration at this site has averaged $13 \mu\text{g}/\text{m}^3$. The highest 24-hour average PM_{10} concentration was $41 \mu\text{g}/\text{m}^3$. Consequently, there have been no exceedances at this site of either the 24-hour PM_{10} standard of $150 \mu\text{g}/\text{m}^3$ or the annual average PM_{10} standard of $50 \mu\text{g}/\text{m}^3$.

A second PM_{10} monitoring station is located at the northern edge of Mono Lake, where it is subject to wind erosion along the exposed lakebed. Between 1989 and 1992, the annual average PM_{10} concentration at this site ranged from 10 to $24 \mu\text{g}/\text{m}^3$. No violations of the 24-hour PM_{10} standard were recorded between 1989 and 1991, but three violations occurred in 1992. Some of the variability in PM_{10} concentrations at this site may be due to changes in the surface area of the lake. But the required sampling schedule of every-6th-day could easily miss dust storms in some years.

Based on analogy to the Mono Lake Basin, annual average PM_{10} concentrations in Honey Lake Valley are probably low, in the range of 10 to $15 \mu\text{g}/\text{m}^3$. Exceedances of the 24-hour PM_{10} standard are probably rare, except during drought conditions when large parts of the bed of Honey Lake are exposed to strong winds.

3.2.2.2 *Delivery/Use Area*

Lemmon and Spanish Springs Valleys are currently in attainment/unclassified with respect to all national air quality standards, with the exception of ozone. The current population in these two valleys is small, hence emissions of nitrogen oxides and hydrocarbons are also expected to be small. No baseline air quality measurements have been collected in Lemmon and Spanish Springs Valleys to characterize site-specific conditions.

3.2.2.3 *Truckee Meadows*

The Truckee Meadows is designated nonattainment (moderate) for carbon monoxide and particulate matter. The nonattainment area does not include Lemmon and Spanish Springs Valleys. The Truckee Meadows, along with all of Washoe County, is classified as nonattainment (marginal) for ozone.

Table 3.2-2 shows the number of times the federal standards for carbon monoxide, particulates, and ozone have been exceeded in the Truckee Meadows. Table 3.2-3 summarizes the health effects posed by high levels of these air pollutants.

TABLE 3.2-2 COMPARISON OF AIR QUALITY DATA COLLECTED WITHIN THE TRUCKEE MEADOWS METROPOLITAN AREA WITH FEDERAL STANDARDS				
Pollutant	Averaging Period	Federal and Nevada Standards	Number of Times Standard was Exceeded^(a)	Nonattainment Classification
Particulate ^(b) Matter (PM ₁₀)	24-Hr	150 µg/m ³	0 (1992) 7 (1991) 6 (1990)	Moderate
	Annual Arithmetic Mean	50 µg/m ³	0 (1992) 0 (1991) 0 (1990)	Moderate
Ozone (O ₃) ^(c)	1-Hr	0.12 ppm	0 (1992) 0 (1991) 4 (1990)	Marginal
Carbon Monoxide (CO)	8-Hr	9 ppm	0 (1992) 4 (1991) 7 (1990)	Moderate
^(a) Monitored data supplied by Air Quality Management Division, Washoe County District Health Department. ^(b) Particles less than 10 microns in size. µg/m³ = micrograms per cubic meter ^(c) ppm = parts per million				

3.2.3 *Area Emission Inventories*

3.2.3.1 *Pipeline Routes and Water Source Area*

Because of the small population and the minor level of human activities along the pipeline routes and in Honey Lake Valley, air quality in these areas is considered to be good, notwithstanding the county-wide nonattainment designation for ozone. Consequently, no emissions inventory, which is an accounting of the major sources of pollutants, is available for these areas.

3.2.3.2 *Delivery/Use Area*

Because of the small population and the minor level of human activities in Lemmon and Spanish Springs Valleys, air quality is considered to be good (notwithstanding the

TABLE 3.2-3	
HEALTH EFFECTS FROM CARBON MONOXIDE, OZONE, AND PARTICULATES (PM ₁₀)	
Air Pollutant	Adverse Effect
Carbon Monoxide	• Impairment of oxygen transport in the bloodstream, increase of carboxyhemoglobin • Aggravation of cardiovascular disease • Impairment of central nervous system function • Fatigue, headache, confusion, dizziness • Can be fatal in the case of very high concentrations in enclosed places
Ozone	• Eye irritation • Respiratory function impairment
Particulates (PM ₁₀)	• Increased risk of chronic respiratory illness with long exposure • Altered lung function in children • May produce acute illness in the presence of SO₂ • May be inhaled and lodge in the lungs. Children, the elderly and those with cardiovascular and respiratory problems are especially susceptible to increased respiratory problems and illnesses
Sources: LADWP and County of Inyo, 1991; Butler, 1979.	

nonattainment designation for ozone). Consequently, no emissions inventory is available for these valleys.

3.2.3.3 Truckee Meadows

• *Particulate Matter*

The Washoe County District Health Department has developed an emissions inventory for particulate matter for 1990 as part of the SIP for the Truckee Meadows (Washoe County District Health Department, 1991; 1992a). Table 3.2-4 summarizes both the annual and winter-season emission inventories for particulates. Historically, violations of air quality standards have occurred during the winter season.

Three of the ten emission sources in Table 3.2-4 (paved streets, street sanding and unpaved streets) are primarily the result of motor vehicles. Motor vehicles account for 66 percent of the particulate emissions in the Truckee Meadows nonattainment area. Residential woodstoves and fireplaces, in combination with motor vehicles, account for 89 percent of the winter-season particulates in the nonattainment area. No violations were recorded in 1992.

Carbon Monoxide

The Health Department recently updated a 1988 emissions inventory for carbon monoxide in the Truckee Meadows nonattainment area and released a draft 1990 emissions inventory (Washoe County District Health Department, 1992b). Table 3.2-5 summarizes both the annual and winter-season carbon monoxide emission inventories. Historically, violations of air quality standards have occurred during the winter season. No violations were recorded in 1992.

Two categories listed in Table 3.2-5 include a wide variety of machinery using internal combustion engines. The non-road gasoline vehicle category includes recreation vehicles, lawn and garden equipment, construction equipment, industrial/commercial equipment and farm equipment. The non-road diesel vehicle category includes construction equipment, industrial/commercial equipment, and farm equipment. As indicated on the table, on-road vehicles and residential wood burning contributed 87.5 percent of the total winter-season carbon monoxide emissions in the nonattainment area in 1990.

Hydrocarbons

The Health Department developed a 1990 emissions inventory for hydrocarbons in the Truckee Meadows nonattainment area for the summer season, when ambient ozone impacts are the highest (Washoe County District Health Department, 1991). Ozone is a secondary pollutant formed by atmospheric reactions between nitrogen oxides and hydrocarbons, which are referred to as ozone precursors. An analysis of ambient ozone concentrations therefore focuses on an emissions inventory of these ozone precursors. Traditionally, most of the emphasis has been placed on emission inventories of hydrocarbons. No ozone violations were recorded in 1992.

Table 3.2-6 shows that motor vehicles are the source of about 68 percent of the hydrocarbons during the summer. Motor vehicles, along with the use of solvents and various industrial processes, are responsible for almost 90 percent of the hydrocarbon emissions during the summer.

TABLE 3.2-4				
1990 PM ₁₀ EMISSIONS INVENTORY FOR THE TRUCKEE MEADOWS NONATTAINMENT AREA				
Annual Total		Source	Winter Season	
Rank	Percent		Rank	Percent
1	67.6	Paved Streets	1	55.0
3	6.7	Woodstoves/Fireplaces	2	23.0
4	4.3	Motor Vehicles	3	5.8
2	11.3	Construction	4	4.5
8	1.1	Street Sanding	5	4.2
5	2.9	Aircraft	6	3.1
7	1.4	Unpaved Streets	7	1.1
6	2.4	Sand & Gravel Operations	8	1.0
9	0.7	Charbroilers	9	0.7
10	0.6	Railroads	10	0.6
Source: Washoe County District Health Department, 1991.				

TABLE 3.2-5

**1990 CO EMISSIONS INVENTORY FOR THE
TRUCKEE MEADOWS NONATTAINMENT AREA**

Annual Total		Source	Winter Season	
Rank	Percent		Rank	Percent
1	72.5	On-Road Vehicles	1	57.9
3	9.8	Residential Wood Combustion	2	29.6
2	11.9	Non-Road Gasoline Vehicles	3	8.4
4	3.1	Non-Road Diesel Vehicles	4	1.9
5	1.8	Aircraft	5	1.5
7	0.2	Stationary Source Fuel Combustion	6	0.3
6	0.4	Miscellaneous Area Sources	7	0.2
8	0.2	Railroads	8	0.2

Source: Washoe County District Health Department, 1992b.

TABLE 3.2-6

**1990 HYDROCARBON EMISSIONS INVENTORY FOR THE
TRUCKEE MEADOWS NONATTAINMENT AREA**

Annual Total		Source	Summer Season	
Rank	Percent		Rank	Percent
1	70.9	Motor vehicles	1	67.6
2	8.4	Solvent use (commercial/consumer)	2	10.9
4	6.4	Industrial processes and coatings	3	10.0
5	3.7	Gasoline Storage/marketing	4	4.1
3	7.1	Residential wood combustion	5	3.3
6	2.4	Other transportation sources (aircraft, railroads)	6	2.9

Source: Washoe County District Health Department, 1991.

3.3 SURFACE WATER

Surface waters discussed in this section include lakes, seeps, springs, creeks, streams, and rivers. Figures 3.3-1 and 3.3-2 show the distribution of these surface waters. Also discussed are the dry washes that are abundant in the region. Wetlands are described in Section 3.5. Appendix B contains information on the discharge rate and the chemical and physical characteristics of the streams, springs, and wells in the water source area, as well as the location of all drainages along the proposed and alternative pipeline routes. Note that there are two distinct drainages called Cottonwood Creek in the affected area. One is in Warm

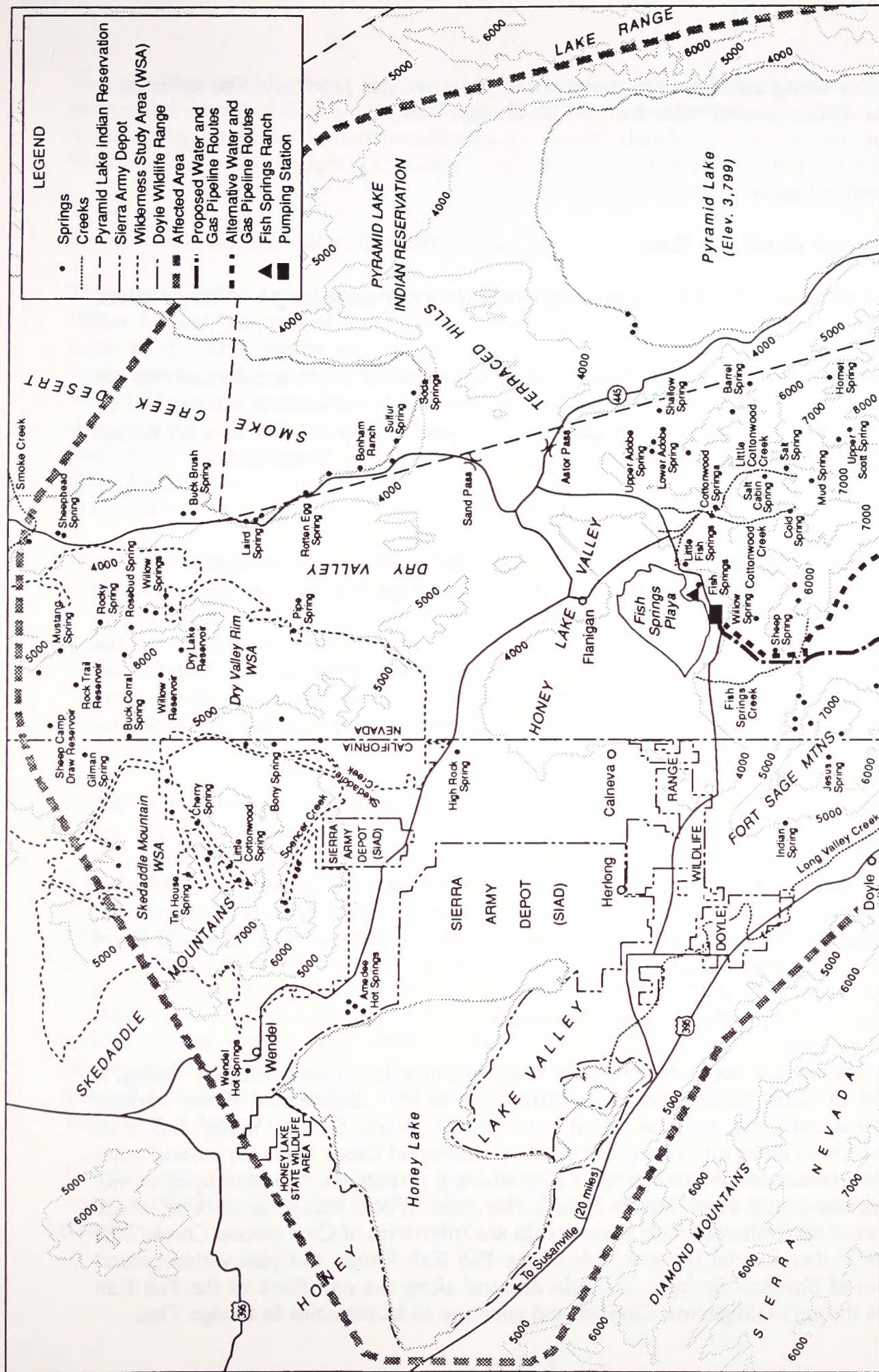


Figure 3.3-2

Surface Waters in the Water Source Area

AFFECTED AREA

Springs Valley along and near the route of the proposed gas pipeline. The other is in Honey Lake Valley several miles east of Fish Springs Ranch.

3.3.1 Pipeline Routes

3.3.1.1 Proposed Bedell Flat Route

No springs occur within the 100-foot-wide right-of-way for the entire length of the water and gas pipelines.

The surface water resources that are along the proposed pipeline routes are divided into two sections: the Fish Springs Ranch-Lemmon Valley section and the Northern Hungry Valley-Dodge Flat section containing only the gas pipeline. Water quality and flow data for surface waters in this region are limited; available data are contained in Appendix B.

- ***Fish Springs Ranch-Lemmon Valley Section***

Starting from Fish Springs Ranch and travelling southward, the pipelines would cross Fish Springs Creek and pass a few hundred feet west of Fort Sage Mud Spring. Upon crossing the Virginia Mountains, the pipelines would descend into and cross three forks of Dry Valley Creek. These forks flow during the spring and early summer, but dry up as the summer progresses. Dry Valley Creek flows westward into Long Valley, joins Long Valley Creek, and then flows northward into Honey Lake Valley. Near Doyle, California, Long Valley Creek has a drainage area of 135 square miles and an average flow of 8,400 acre-ft/yr (Rockwell, 1990).

Continuing southward, the water and gas pipelines would pass near several springs and eventually through Bedell Flat, a major drainage basin. Between Hungry Mountain and Warm Springs Mountain, the water and gas pipelines would separate and continue in different directions. The water pipeline would turn south and pass through Hungry Valley to its terminus in Lemmon Valley. No springs or streams occur along or near the route of the water pipeline through Hungry and Lemmon Valleys. The gas pipeline would travel eastward to its terminus in Dodge Flat, as described next.

- ***Northern Hungry Valley-Dodge Flat section***

Where the gas pipeline separates from the water pipeline in northern Hungry Valley, it would travel eastward passing within a quarter mile of both Coyote and Butler Springs. Continuing eastward, the pipeline would pass through Warm Springs Valley and cross Cottonwood Creek along an existing dirt road. Cottonwood Creek flows for several miles to the northwest through Warm Springs Valley where it terminates. Continuing eastward, the gas pipeline would cross Home Ranch, Hay, and Wilcox Canyons, each of which contains a small intermittent creek; these creeks are tributaries of Cottonwood Creek. The pipeline would then ascend the west side of the Pah Rah Range and pass within several hundred feet of Sheehan Springs. It would descend along the east flank of the Pah Rah Range, pass through Olinghouse Canyon, and continue to its terminus in Dodge Flat.

The pipelines would cross a total of eight perennial or intermittent streams and 80 dry washes, for a total of 88 drainage crossings. Many of the dry washes contain flowing water in the spring during the short snowmelt season. Summer thunderstorms can also cause local flash flooding in dry washes. Little data have been collected to document their discharge.

3.3.1.2 Winnemucca Valley Alternative Route

This route is identical to the proposed route from the pumping station in Honey Lake Valley to near the crest of the Virginia Mountains. The Winnemucca Valley route then turns to the east, passes near a spring at Newcombe Lake (dry), and descends into Winnemucca Valley crossing several forks of Dry Valley Creek. The route would pass within 100 feet of two springs in Winnemucca Valley and, farther south, pass near another cluster of springs at the northern end of Warm Springs Valley. The route of the gas pipeline would be identical to the proposed route from northern Hungry Valley to Dodge Flat. From northern Hungry Valley, the water pipeline would follow a route identical to the proposed route to its terminus in Lemmon Valley.

The pipelines would cross a total of seven perennial or intermittent streams and 66 dry washes, for a total of 73 drainage crossings.

3.3.1.3 Antelope Valley Alternative Route

The Antelope Valley route is similar to the proposed route, except that the water pipeline would extend through Antelope Valley, instead of Hungry Valley, where it would pass along the west side of a small playa. The water and gas pipelines would cross a total of eight perennial or intermittent streams and 80 dry washes, for a total of 88 drainage crossings.

3.3.1.4 Red Rock Valley Alternative Route

The Red Rock Valley water-pipeline route is identical to the proposed route from Honey Lake Valley to northern Bedell Flat. From there, the Red Rock Valley water pipeline would diverge to the southwest and travel through Red Rock Valley. On its ascent out of the south end of Red Rock Valley, the route would pass through a two-mile section of springs, flowing streams, and wetlands. From there, the route would cross a gap at the southern end of the Sand Hills, pass within several hundred feet of Juniper Springs, and descend into Lemmon Valley. The route of the gas pipeline would be identical to the Winnemucca Valley route.

The pipelines would cross a total of eight perennial or intermittent streams, a two-mile complex of wetlands in Red Rock Valley, and 89 dry washes, for a total of 98 drainage crossings.

3.3.2 *Water Source Area*

3.3.2.1 *Streams*

Honey Lake Valley has a drainage area of 2,200 square miles; the valley floor is 600 square miles. Precipitation in the east end of the valley is four inches per year and 14 to 20 inches per year in the nearby mountains (Handman et al., 1990). The west side of the valley receives 10 inches of precipitation per year and 30 inches in the nearby mountains (Rockwell, 1990).

On rare occasions -- such as strong Pacific-frontal storms, heavy thunderstorms, and periods of intense snowmelt -- the few streams in the mountains surrounding eastern Honey Lake Valley discharge water to the valley floor. Even the relatively large streams draining the mountains south of Honey Lake Valley, such as Long Valley Creek (and its main tributary, Dry Valley Creek), Fish Springs Creek, and Cottonwood Creek, rarely maintain flows into the valley. Peak flows occur in early spring, with the majority of flow derived from snowmelt; base flows occur in late summer and fall. Appendix B contains additional information on stream flow.

The largest perennial stream near Fish Springs Ranch is Cottonwood Creek. The creek drains a 15 square-mile watershed in the Virginia Mountains and enters Honey Lake Valley about three miles east of Fish Springs Ranch. A ditch diverts part of the flow of Cottonwood Creek to a wetland along the southeast edge of the playa near the ranch. Cottonwood Creek flows along a large north-trending fault zone and has an average annual runoff of 1,600 acre-feet (Handman et al., 1990). Snowmelt and numerous upland springs supply most of the flow.

Data on the water quality of streams in the vicinity of Honey Lake Valley are sparse. Rockwell (1990) sampled several streams in the area and all had similar water quality; no dominant cations, similar concentrations of calcium, magnesium, sodium and potassium, and bicarbonate as the predominant anion (Appendix B). Salinity and alkalinity in surface waters in the region are generally low to moderate, except near playas where water quality is marginal to poor.

3.3.2.2 *Springs*

Numerous springs and seeps occur in the foothills and uplands bordering Honey Lake Valley. Most of the springs discharge small amounts of water and all tend to have similar water quality (Appendix B). Several springs also occur on the floor of Honey Lake Valley, including Fish Springs (now dry), High Rock Spring, and Little Fish Springs (now dry). Springs also occur in the Smoke Creek Desert along the southwest edge of the playa, including a large concentration of springs and naturally flowing wells at Bonham Ranch.

Two spring and seep surveys have been conducted over most of Honey Lake Valley, watersheds that are tributary to the valley, and in the southern Smoke Creek Desert (JBR, 1990). Of the 166 springs evaluated, 53 percent discharged less than one gallon per minute

(gpm), 31 percent discharged one to five gpm, and 16 percent discharged more than five gpm. Some of the springs in East Cottonwood and Cottonwood Creeks discharge at rates of 30 to 40 gpm; both creeks contain extensive areas of riparian vegetation. Fish Springs maintained a natural flow of 1,600 gpm prior to irrigation pumping (Rush and Glancy, 1967); currently there is no discharge from Fish Springs. High Rock Spring in northern Honey Lake Valley discharges at a rate of 809 gpm. The water is used for irrigation, fish rearing, and potable supply.

Water quality of springs discharging from volcanic tuffs is dominated by sodium cations, whereas springs discharging from basalts are dominated by calcium cations. Bicarbonate is the dominant anion at most springs in the region.

The following descriptions characterize the more prominent areas of springs in the water source area. All these springs, with the exception of those at High Rock Ranch and in the Smoke Creek Desert, are *above*, and not connected to, the regional groundwater table.

Cottonwood Canyon: (three miles east of Fish Springs Ranch):

- 12 springs
- all have similar water quality
- TDS concentrations range from 140 to 224 ppm
- pH ranges from 6.7 to 7.7
- temperature ranges from 39 to 57 °F
- discharge ranges from 0.6 to 11 gpm, with 20 percent of springs discharging 1.0 gpm or less

East Cottonwood Canyon: (four miles east of Fish Springs Ranch):

- 20 springs
- all have similar water quality
- TDS concentrations range from 133 to 210 ppm
- pH ranges from 6.6 to 8.0
- temperature ranges from 43 to 66 °F
- discharge ranges from 0.4 to 42 gpm, with 29 percent of springs discharging 1.0 gpm or less

Virginia Mountains: (includes all springs to the south and west of Fish Springs Ranch, excluding the Cottonwood Canyon area):

- 16 springs
- variable water quality among springs
- TDS concentrations range from 140 to 798 ppm
- pH ranges from 6.9 to 8.1
- temperature ranges from 37 to 61 °F
- discharge ranges from 0.1 to 26 gpm, with 62 percent of springs discharging 1.0 gpm or less

Fort Sage Mountains:

- 24 springs
- variable water quality among springs
- TDS concentrations range from 144 to 742 ppm
- pH ranges from 6.5 to 8.1
- temperature ranges from 37 to 66 °F
- discharge ranges from 0.1 to 7.9 gpm, with 61 percent of springs discharging 1.0 gpm or less

High Rock Spring:

- 1 large spring
- good water quality
- TDS concentration of 170 ppm
- pH of 8.6
- temperature of 81 °F
- discharge of 809 gpm
- dominant ion is bicarbonate

Smoke Creek Desert:

- 22 springs
- variable water quality among springs
- TDS concentrations range from 840 to 3,780 ppm
- pH ranges from 6.4 to 9.0
- temperature ranges from 57 to 118 °F
- discharge ranges from a trace to 145 gpm, with 30 percent of springs discharging 1.0 gpm or less

Except for High Rock Spring, the springs and wells in the Smoke Creek Desert have the highest rates of flow in the area. The well just west of the ranch house at Bonham Ranch discharges at a rate of 145 gpm at a temperature of 95 °F. Several other wells in this area discharge at more than 100 gpm. The wells and springs in the Smoke Creek Desert also have the poorest water quality of all the springs in the water source area.

3.3.2.3 Honey Lake

Honey Lake is the most prominent body of water in Honey Lake Valley. The surface area of the lake fluctuates seasonally and has dried up more than a dozen times since 1859 (Rockwell, 1990; recent observations). On average, however, Honey Lake encompasses 47,000 acres with a volume of 120,000 acre-feet (Handman et al., 1990). At that volume, the lake is less than 10 feet deep.

Attempts have been made to use Honey Lake for irrigation, but the shallowness and fluctuating water levels make large-scale pumping inefficient. According to Rockwell (1990),

most pumping stations were abandoned in the early 1900s, but one ranch still uses lake water for irrigation.

The quality of the water in Honey Lake becomes better as the volume of the lake increases. As the lake shrinks, evaporation concentrates the dissolved salts and the water quality becomes progressively poorer. An average of three late-summer water samples taken over the last 40 years (September 1953, September 1973, and September 1988) yielded a concentration of total dissolved solids (TDS) of 2,877 parts per million (ppm). The chemical composition of Honey Lake is considerably different (the water quality is poorer) than that of nearby creeks (Rockwell, 1990). Effluent from water treatment plants along the Susan River and from agricultural runoff are the largest contributors to the lake's poor water quality.

The chief source of water for Honey Lake is the Susan River (Rockwell, 1990). Handman et al. (1990) estimate that the total average annual inflow to the lake from all sources is 130,000 acre-feet. Observations of the lake floor during dry periods demonstrate that several springs discharge groundwater directly to the lake through the lakebed, but the volume of this discharge is negligible (Rockwell, 1990). In dry years, the only flow to reach the lake is a small amount of irrigation-return water, some water from seeps and springs in the lake bottom, and some water discharged from geothermal power plants near Wendel and Amedee. The quantities involved from each water source during wet and dry years are unknown.

3.3.2.4. Pyramid Lake

The Pyramid Lake drainage area is 2,730 square miles (U.S. Geological Survey, 1985). The Truckee River is the main source of water for the lake. From 1973 to 1989, the average annual discharge of the Truckee River into Pyramid Lake was 477,000 acre-ft/yr (USGS, 1992). An additional 6,400 acre-ft/yr of surface water flows into the lake from the surrounding mountains. During the wet year of 1983, 1,889,000 acre-feet flowed into Pyramid Lake from the Truckee River, whereas only 48,000 acre-feet flowed into the lake during the drought year of 1934 (Westpac Utilities, 1988; 1989). Flows during the past six drought years have been very low. The Truckee River is expected to have above average flows during the 1992-1993 water year.

Because of diversions associated with the Newlands Reclamation Project and the Reno-Sparks metropolitan area, as well as occasional droughts, the level of Pyramid Lake has dropped more than 80 feet between 1909 and 1968; Winnemucca Lake, located in the valley immediately east of Pyramid Lake, dried up in the 1930s; and the TDS level of Pyramid Lake has increased from about 3,500 to 5,500 ppm (Sigler et al., 1985). Since 1968, the elevation of Pyramid Lake has risen about 15 feet from a low of about 3,785 to its current elevation of about 3,800.

3.3.3 *Delivery/Use Area*

3.3.3.1 *Lemmon Valley*

Surface water in Lemmon Valley is scarce, although occasional thunderstorms and snowmelt can fill Lemmon playa on the east side of the valley and Silver Lake playa on the west side. Water is discharged to Lemmon playa from two wastewater treatment plants (Regional Water Planning and Advisory Board, 1990; Washoe County, 1992). The Reno-Stead treatment facility discharges treated wastewater to Lemmon playa via an unnamed ditch. Remaining capacity at this facility could support an additional 5,750 people. Wastewater is also occasionally discharged to Lemmon playa from Washoe County's wastewater treatment plant in Lemmon Valley. Remaining capacity at the Lemmon Valley facility could support an additional 660 people. See Appendix B for the discharge limitations for each of these facilities.

3.3.3.2 *Spanish Springs Valley*

Surface waters in Spanish Springs Valley are related chiefly to leakage and irrigation practices associated with the Orr Ditch, an irrigation canal built in the late 1870s to supply water from the Truckee River to ranches in Spanish Springs Valley. The ditch flows through the southern half of Spanish Springs Valley and returns to the Truckee River in east Sparks via the North Truckee Drain.

Hadiaris (1988) estimates that an average of 17,355 acre-ft/yr entered Spanish Springs Valley through the Orr Ditch between 1977 to 1984; flows decreased from 1985 to 1987 to an average of 11,750 acre-ft/yr. A Federal District Court decision in 1984 decreed that 3.73 acre-ft/yr per acre is currently authorized to flow through the Orr Ditch to Spanish Springs Valley. The 1992 target diversion through the Orr Ditch is 14,142 acre-ft based on 2,427 acres of irrigable land in the valley (Stone, 1992). This amount accounts for losses through the ditch, which is mostly unlined.

The quality of water in the Orr Ditch in Spanish Springs Valley was evaluated by Rush and Glancy (1967) and Mahoney et al. (1978). The water was of a mixed bicarbonate type, with no excessive salinity or alkalinity. The pH was 7.6 to 8.0, with low specific conductance, and a TDS value of 54 ppm. Calcium, magnesium, sodium, chloride, and sulfate were recorded at moderate levels. The amount of dissolved and suspended constituents in Orr Ditch water is relatively high compared to the Truckee River, but not high enough to limit its use. Two coliform bacteria measurements in August of 1977 were high, but declined when measured again in September of that year. The quality of Orr Ditch water declines upon its diversion from the Truckee River, possibly due to decreased velocity, warmer temperatures, and increased contact with agricultural and urban runoff.

Wastewater from residential development in the southern part of Spanish Springs Valley is sewered back to the Truckee Meadows Water Reclamation Facility in Sparks. No wastewater treatment facilities currently exist in the valley.

3.3.4 *Truckee River*

The drainage basin of the Truckee River measured upstream from Pyramid Lake is 1,960 square miles (Glancy et al., 1972). Average discharge at Reno is 513,700 acre-ft per year, but river flows are highly variable (U.S. Geological Survey, 1985). Peak flows occur in response to spring snowmelt and base flows occur in the fall after the summer dry season. During the wet year of 1983, 1,769,000 acre-feet flowed through Reno. In 1991, only about 126,000 acre-ft flowed through Reno (U.S. Geological Survey, 1992). The Truckee River is expected to have above average flows during the 1992-1993 water year.

Between the towns of Truckee, California, and Reno, the Truckee River is a fast-flowing stream with good water quality. It has a low temperature, high concentrations of dissolved oxygen, and moderate pH. As the Truckee River flows through Reno, the water quality is degraded. The Reno-Sparks urban area and irrigation return flows are important sources of non-point-source water pollutants. In addition, there are many competing demands for, and diversions of, Truckee River water. In some years, there are insufficient amounts of water to adequately meet the needs of threatened and endangered species, wetlands, wildlife refuges, agriculture, and municipal and industrial customers in the Reno-Sparks area.

The Truckee River below the Truckee Meadows Water Reclamation Facility has elevated levels of nitrogen and phosphorous, as well as other undesirable constituents. The facility is designed to treat up to 40 million gallons per day (mgd) of effluent. Sparks retains rights to 13.5 mgd of capacity; Reno has 26.5 mgd. The design capacity of 40 mgd is roughly equivalent to a community water-use rate of 90,000 acre-ft/yr; current water use is about 65,000 acre-ft/yr. Appendix B lists the discharge requirements for the facility. The facility occasionally exceeds discharge TDS, temperature, and other parameters. Higher-than-allowable concentrations of some constituents are a problem during drought conditions when high-TDS groundwater comprises a large component of the total water entering the facility for treatment and disposal.

Water quality standards for the Truckee River are specified in Nevada Administrative Code 445.1339; 445.121-125; and 445.134625-13473. Truckee River ambient water quality has exceeded water quality standards in different reaches of the river at different times for the parameters of temperature, phosphorous, fecal coliform, TDS, pH and nitrogen.

3.4 *GROUNDWATER*

On March 1, 1991 (as subsequently amended), the Nevada State Engineer ruled that Washoe County could export 13,000 acre-ft/yr of groundwater from Fish Springs Ranch in Honey Lake Valley. The State Engineer based his decision in part on the results of computer modeling of the groundwater system in Honey Lake Valley conducted by the U.S. Geological Survey (USGS) (Handman et al., 1990).

The USGS study estimated the effects that pumping 15,000 acre-ft/yr at Fish Springs Ranch would have on groundwater, particularly regional flow and depth to the water table. This amount was 2,000 acre-ft/yr more than the State Engineer ultimately approved for export.

The USGS computer model was therefore modified for use in this EIS. The first modification was to alter the pumping rate from 15,000 acre-ft/yr to 13,000 acre-ft/yr. Next, the number of simulated pumping wells was reduced from 18 to nine, and they were confined to the area of Fish Springs Ranch (the actual number of pumping wells proposed by Washoe County is 10, as shown on Figure 2-5). The last modification was to expand the area modeled by the USGS three miles to the west to include the Sierra Army Depot, and to include groundwater pumping at the Depot in the model. Appendix C describes the construction of the USGS model, how the USGS model was modified for this EIS, and the results of the modeling effort.

The USGS study did not evaluate the effects that pumping at Fish Springs Ranch would have on groundwater quality. Public scoping for this EIS, however, indicated that this was a major issue. To address this issue, a water-quality model of Honey Lake Valley and surrounding areas was developed. It used the output of the USGS model as modified for this EIS. Appendix C describes the construction of the water-quality model and the results of this modeling effort.

The following description of the groundwater conditions in Honey Lake Valley and surrounding areas is based chiefly on the USGS study by Handman et al. (1990). Other sources of information included Rush and Glancy (1967), Hilton (1963), Guyton Associates, Inc. (1986), Rockwell (1990), Beck and Associates (1987), Muir (1988), and several reports by the California Department of Water Resources (March 3, 1988, June 14, 1968, September 28, 1987, February 25, 1988, and December 11, 1970). Also used were data submitted by Washoe County to the Nevada State Engineer during the 1990 hearings on Washoe County's applications to divert groundwater from Honey Lake Valley.

3.4.1 Pipeline Routes

The pipelines would be buried to a minimum depth of three feet below the surface and a maximum depth at stream crossings of about 12 feet. Groundwater resources would not be affected except at site-specific locations which are not yet known. Therefore, a description of groundwater conditions along and near the pipeline routes is not included. The potential impacts of pipeline construction on groundwater resources is described in Section 4.4.

3.4.2 Water Source Area

3.4.2.1 Groundwater Recharge, Discharge, and Flow

The groundwater conditions in the water source area described in this section are those that existed in 1988 and are based on estimates obtained from the USGS computer-flow model as modified for use in this EIS (hereafter referred to as the *modified USGS model*). In that year, the depth to groundwater was neither rising nor falling in response to water use in Honey Lake Valley (this is referred to as *equilibrium* or *steady-state conditions*). Groundwater data collected since 1988 indicate that the valley is still in equilibrium. The *perennial* or *safe yield* of eastern Honey Lake Valley (the amount of groundwater that can

be economically pumped over the long term without mining groundwater) was estimated by the Nevada State Engineer on March 1, 1991, to be 13,000 acre-ft/yr — the amount that would be exported by Washoe County.

Depth to groundwater in eastern Honey Lake Valley ranges from about 13 feet to almost 50 feet below the surface. Groundwater elevations vary from 3,960 feet above mean sea level at Fish Springs Ranch to 4,050 feet in the Skedaddle Mountains (Figure 3.4-1). A cone of depression exists at the Sierra Army Depot caused by Depot pumping. Groundwater at the Depot is projected by the modified USGS model to range in elevation from 3,830 to 3,960 feet; east of the Depot at Calneva the groundwater elevation is about 3,970 feet (Figure 3.4-1). Recent information obtained by the Depot suggests that groundwater levels at the Depot may be shallower than projected by the modified USGS model.

The direction of groundwater flow is shown on Figure 3.4-1. Flow directions are for roughly the upper 200 to 300 feet of aquifer. Flow directions in deeper parts of the valley are poorly understood (Figure 3.4-2). Groundwater moves northward into Honey Lake Valley from the Virginia and Fort Sage Mountains. Groundwater in shallow aquifers beneath Honey Lake flows eastward to the Nevada side of the valley. Limited flow may also occur westward toward Honey Lake in shallow and deep aquifers. Groundwater in shallow aquifers in the northern two-thirds of the Sierra Army Depot generally flows towards Honey Lake. At the southern end of the Depot, water flows towards the Depot's well field (Figure 3.4-1). Groundwater in eastern Honey Lake Valley flows eastward to Pyramid Lake Basin and northward to the Smoke Creek Desert. Groundwater also flows to the interior of Honey Lake Valley from the mountains north of the valley.

Estimated rates of groundwater recharge and discharge calculated from the modified USGS model are summarized on Table 3.4-1. For comparison, original estimates of recharge and discharge from the USGS model are included on the table.

Data on recharge and discharge of groundwater in the Smoke Creek Desert hydrologic basin are very limited. A rough estimate of the perennial yield of the basin is 16,000 acre-feet (Nevada Department of Conservation and Natural Resources, 1992). This estimate was made 25 years ago based on few empirical data (Glancy and Rush, 1968). The USGS is currently re-studying the water budget of the Smoke Creek Desert.

Groundwater flow to the Smoke Creek Desert from Honey Lake Valley is estimated to be 5,273 acre-ft/yr (Table 3.4-1). Monitoring by the USGS suggests that groundwater could also be flowing from the Smoke Creek Desert toward Pyramid Lake. This flow is estimated at about 2,600 acre-ft/yr. Current committed resources in the Smoke Creek Desert amount to 6,392 acre-ft/yr (Nevada Department of Conservation and Natural Resources, 1992). Assuming that 16,000 acre-feet is the perennial yield of the Smoke Creek Desert, then 9,608 acre-feet is currently uncommitted. Washoe County has submitted applications for these remaining uncommitted water resources.

LEGEND

-  Elevation of Groundwater Surface, in Feet above Sea Level
-  Direction of Groundwater Flow
-  Area of Groundwater Model
-  Groundwater Model Boundary
-  Proposed Route
-  Alternative Route
-  Pyramid Lake Indian Reservation
-  Sierra Army Depot
-  Doyle Wildlife Range
-  Affected Area

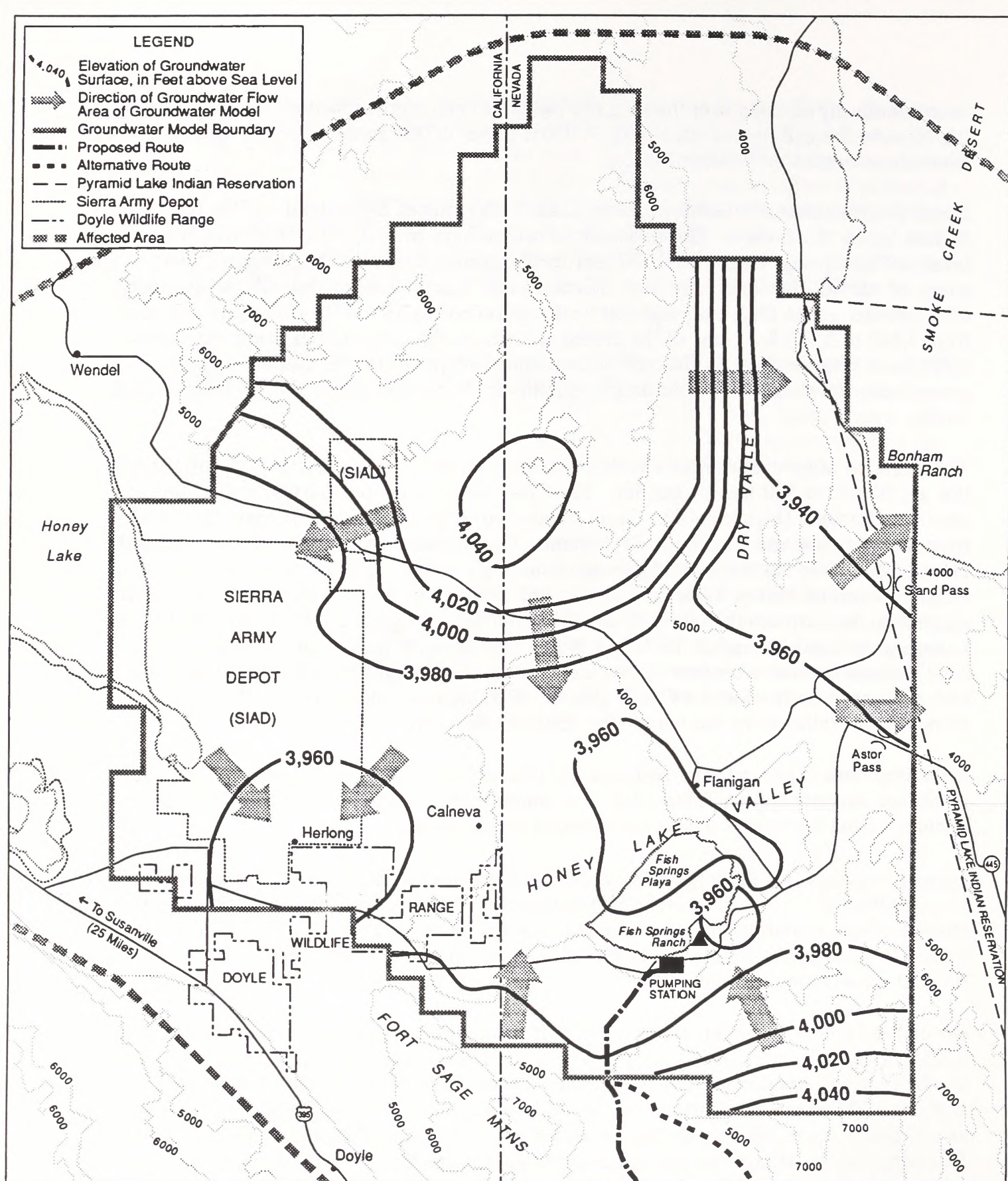


Figure 3.4-1

Computer Simulated Groundwater Elevation and Flow Direction
 (The Difference Between the Elevation of the Groundwater Surface and the Land Surface is a Rough Estimate of the Depth to Groundwater Below the Surface)



0 3
MILES

Contour Interval = 1,000 ft.



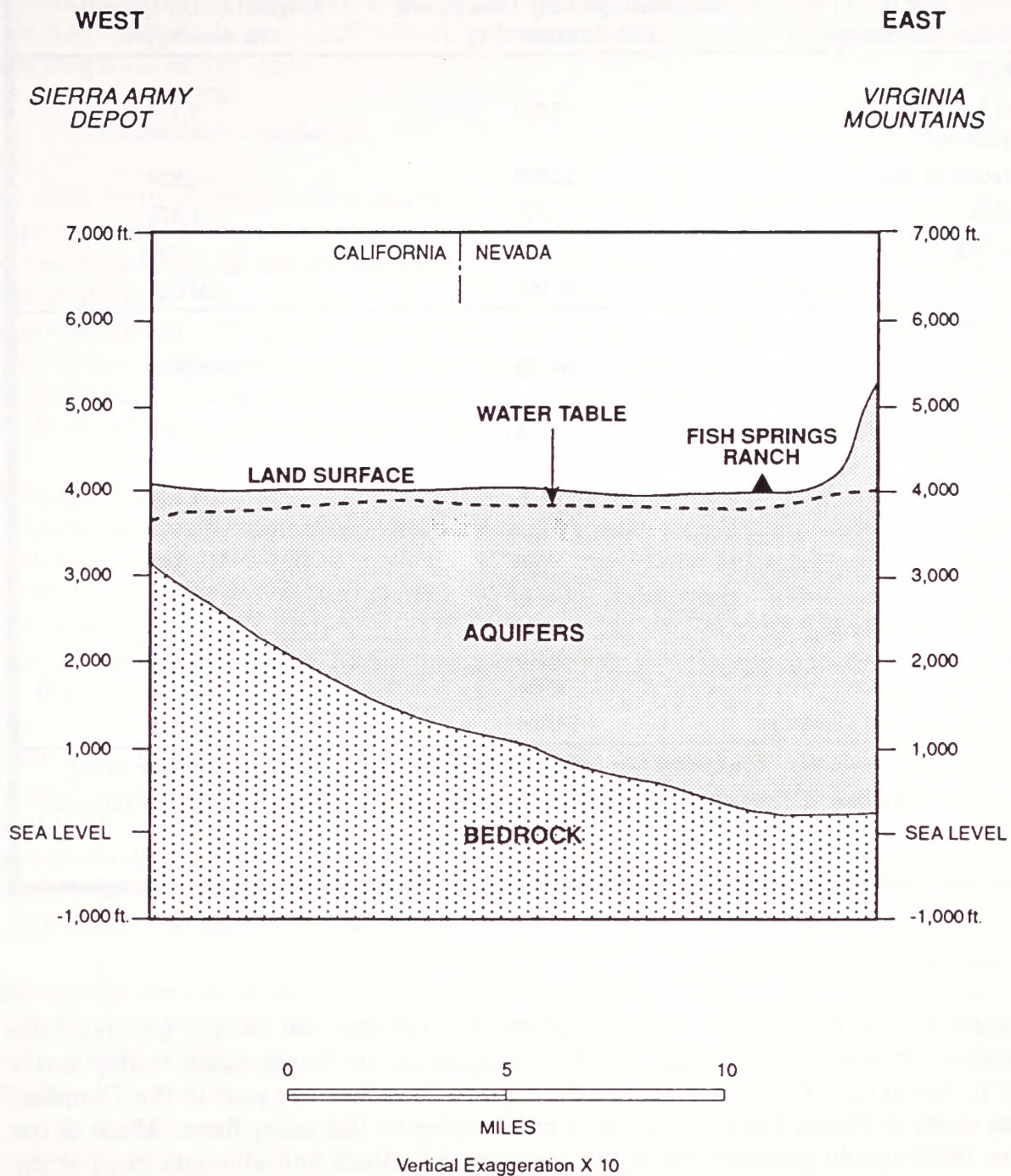


Figure 3.4-2

**Generalized East-West Cross-Section through Eastern Honey Lake Valley
Showing Thickness of Aquifers (modified from Handman et al., 1990)**

TABLE 3.4-1

BASELINE (1988) GROUNDWATER BUDGET USED FOR EIS^(a)

Budget Component	Estimated Quantity Used in this EIS (in acre-ft/yr)	Original USGS Quantity (in acre-ft/yr)
RECHARGE		
• Direct infiltration of precipitation ^(b)	9,339	9,177
• Infiltration of runoff	12,829	12,829
• Irrigation returnflow	1,479	1,479
• Groundwater inflow	1,253	577
Total Recharge	~24,900	~24,062
DISCHARGE		
• Groundwater evapotranspiration	10,185	10,804
• Subsurface outflow to Smoke Creek Desert	5,273	5,287
• Subsurface outflow to Pyramid Lake Valley	1,466	1,468
• Subsurface outflow to Honey Lake	62	589
• Withdrawals from wells:		
Fish Springs Ranch	5,914	5,914
Sierra Army Depot	1,996	0
Total Discharge	~24,896	~24,062
^(a) See Appendix C for details. The budget was estimated using the modified USGS computer model.		
^(b) 5,000 acre-feet per year of this amount is estimated by Handman et al., (1990) to consist of subsurface inflow.		

• Groundwater Recharge

The two main sources of groundwater recharge are precipitation that directly infiltrates the ground and infiltration from surface runoff. Precipitation in Honey Lake Valley varies according to elevation. The USGS reported a high of 20 inches per year in the Diamond Mountains south of Honey Lake and a low of eight inches on the valley floor. Much of the streamflow infiltrates to groundwater in the area where bedrock and alluvium meet at the valley margins; this is believed to be the major process for recharging the aquifers. The USGS estimates that 13,000 acre-ft/yr of streamflow infiltrates to groundwater in eastern Honey Lake Valley.

Recharge of groundwater also occurs by subsurface inflow from adjacent areas including the Fort Sage and Virginia Mountains. It is estimated in this EIS that 1,253 acre-ft/yr flows eastward in shallow aquifers toward the Nevada-California border from Honey Lake.

Recharge of groundwater also occurs from infiltration of irrigation water. Approximately 25 percent of the water used for irrigation at Fish Springs Ranch (currently the only major irrigator on the Nevada side of Honey Lake Valley) is estimated to infiltrate back into the groundwater system (Handman et al., 1990). In 1988, irrigation at the ranch was estimated to be 5,910 acre-ft; hence, 1,500 acre-ft/yr is estimated to re-enter the groundwater system from irrigation return flows.

• *Groundwater Discharge*

The main form of groundwater discharge from Honey Lake Valley is evapotranspiration. Evapotranspiration occurs through evaporation of water from the surface, evaporation from the capillary fringe of the groundwater table, and transpiration of groundwater by plants (phreatophytes) whose roots tap the capillary fringe of the groundwater table. Evapotranspiration in eastern Honey Lake Valley is estimated using the modified USGS model to be 10,185 acre-ft/yr from a combination of phreatophytes and the playa near Fish Springs Ranch. This estimate of evapotranspiration is 619 acre-ft/yr higher than the original USGS model due to the extension of the model three miles to the west (Appendix C).

Discharge of groundwater from Honey Lake Valley also occurs through subsurface outflow to adjacent basins. The modified USGS model predicts that 5,273 acre-ft/yr flows to Smoke Creek Desert and 1,466 acre-ft/yr flows to the Pyramid Lake Basin (Handman et al., 1990). This is in agreement with the original USGS model. Subsurface outflow westward to Honey Lake is estimated at 62 acre-ft/yr. This is a decrease of 528 acre-ft/yr from the original USGS model estimate of 590 acre-ft/yr due to the extension of the model three miles to the west in the modified USGS model.

Discharge of groundwater also occurs through wells. Groundwater pumping for irrigation at Fish Springs Ranch was 5,914 acre-ft/yr in 1988. Pumping at the Sierra Army Depot began in 1942. Pumping averaged between 1,500 and 2,000 acre-ft/yr during the 1980s. It is distributed between four water-supply wells located at the Depot. Pumping from domestic wells distributed throughout the valley in the modeled area was estimated by the USGS to be less than 1,000 acre-ft/yr and it was not included in the modeling analyses.

Fissuring has been reported approximately six miles north of Fish Springs Ranch. The cause of the fissuring is not known, but it could have been initiated by pumping at Fish Springs Ranch. Other possible causes include fault creep or desiccation cracks caused by prolonged drought.

3.4.2.2 *Groundwater Quality*

Water quality records for more than 110 wells in the modeled area cover the period from the early 1950s to the present. The majority of these wells are less than 500 feet deep. No data are available on water quality at greater depths. Most wells were sampled for constituents such as nitrate, sulfate, carbonate, chloride, and total dissolved solids (TDS). Data on metals and radioactive isotopes were available for fewer samples.

Figure 3.4-3 shows the distribution of TDS in Honey Lake Valley and surrounding areas for the upper 500 feet of aquifer. TDS was selected for characterizing water quality due to the direct correlation between TDS and water quality, the large amount of TDS data available, and the wide areal distribution of these data.

Water quality is highly variable with TDS concentrations as high as 50,250 ppm west of the playa at Fish Springs Ranch. Water with TDS concentrations greater than 1,000 ppm is non-potable (Nevada Administrative Code 445). South of the playa, TDS concentrations range from 100 to 400 ppm. Water quality in the area of the proposed well field is good, with TDS ranging from 200 to 300 ppm in most cases. Several miles northeast of the well field, water quality is very poor, with TDS values as high as 50,000 ppm. Poor water quality is present at Astor Pass and Sand Pass with TDS concentrations ranging from 1,600 to 2,500 ppm. Water quality at the Sierra Army Depot is variable, ranging from 290 to 1,020 ppm TDS near the Depot's pumping wells. TDS concentrations in the Long Valley area range from 136 to 249 ppm. TDS concentrations under the playa at Fish Springs Ranch are unknown. They could range from 200 ppm to 50,000 ppm or higher.

Contaminants have been detected in groundwater at the Sierra Army Depot (Sierra Army Depot, 1991). The primary contaminants are organic chemicals such as trichloroethylene and 1,3,5-trinitrobenzene. The extent of the contamination has not been defined, but according to the Depot study, the primary contaminants are relatively immobile in groundwater because of adsorption onto aquifer materials.

3.4.3 Delivery/Use Area

The groundwater descriptions for Lemmon and Spanish Springs Valleys are based on data in Rush and Glancy (1967), Schaefer and Maurer (1981), Harrill (1973), the Washoe County Department of Public Works (1986), Robinson and Phoenix (1948), Guyton Associates, Inc., (1964; 1986), and Hadiaris (1988).

Insufficient published information exists to characterize the water budgets (discharge and recharge) of either valley.

3.4.3.1 Lemmon Valley

Lemmon Valley is a closed drainage basin with groundwater depths that vary from 10 to 100 feet below the surface. Depths are greatest along the margins of the valley and decrease toward the playas in the center of the valley. In 1986 Washoe County reported that the water table in east Lemmon Valley was dropping at a rate of 1.3 feet per year. Due to a continuing decline in the water table, and evidence of groundwater mining, a moratorium on growth was imposed on the valley in 1977. Current depths to groundwater are 35 to 50 feet deeper than they were in the early 1970s (Dragan, 1992). Recharge from the irrigation of golf courses and from septic systems has raised the groundwater table in some areas.

Subsurface inflow of groundwater to Lemmon Valley is probably minor. Inflow occurs from precipitation and infiltration of surface runoff, possible inflow from Cold Springs Valley to the west, and recharge (via wastewater discharges) of part of the 1,300 acre-ft/yr of Truckee Meadows water imported to Stead and Lemmon Valley. Outflow of groundwater is also minimal, occurring from evapotranspiration, subsurface outflow, and pumping. Total inflow and outflow were estimated by Harrill (1973) to be 2,000 acre-ft/yr in the early 1970s. Currently, the Nevada State Engineer estimates the perennial or safe yield of Lemmon Valley (both subbasins) to be 1,500 acre-feet. Groundwater commitments currently total 4,860 acre-feet; hence, the valley is over-appropriated by 3,360 acre-feet.

The quality of groundwater in Lemmon Valley is variable. TDS concentrations average 200 to 300 ppm, but very poor water quality occurs in the vicinity of the playas where TDS concentrations range from 1,300 to 25,000 ppm. Limited evidence suggests that water quality improves at depth below the playas. Some domestic wells in the valley reportedly have increasing concentrations of nitrates, which is presumably related to the use of nearby septic systems.

A groundwater recharge program designed to minimize further declines of the water table in Lemmon Valley, and to provide additional groundwater for domestic well users, has been proposed by the Washoe County Department of Public Works (1986). The plan calls for 250 acre-ft/yr of Truckee River water to be transported via the Stead and Raleigh Heights pipelines to Lemmon Valley for recharge through four injection wells. One well would be located at the north end of Lemmon valley, with the other three wells located at the south end. Washoe County would be the responsible agency for overseeing the recharge study and would need to acquire all necessary permits for this activity, including an underground injection permit from the Nevada Division of Environmental Protection (NDEP).

3.4.3.2 Spanish Springs Valley

Spanish Springs Valley is an alluvium-filled valley bordered by mountain ranges. The southern part of the valley drains southward to the Truckee River; the remainder of the valley has interior drainage. Groundwater inflow to Spanish Springs Valley occurs from precipitation, infiltration of surface runoff, Orr Ditch water that infiltrates directly through the unlined ditch, and infiltration of Orr Ditch water used for irrigation. Approximately 600 to 1,200 acre-ft/yr is recharged from precipitation and 3,000 acre-ft/yr is recharged from the Orr Ditch.

Groundwater outflows occur from evapotranspiration, subsurface outflow, and well pumping. Estimates of evapotranspiration range from 900 acre-ft/yr to 3,000 acre-ft/yr. Phreatophytic plant communities have become established where infiltration of Orr Ditch water has locally caused the water table to rise. As much as 100 acre-ft/yr of subsurface outflow has been estimated to occur southward to the Truckee Meadows and northward to Warm Springs Valley. Hadiaris (1988) estimated inflow and outflow at 2,800 acre-ft/yr. The Nevada State Engineer estimates the perennial or safe yield of Spanish Springs Valley to be 1,000 acre-feet, whereas the committed resource is 10,029 acre-feet; hence, the valley is currently over-appropriated by 9,029 acre-feet.

Few data exist concerning the depth to groundwater and flow directions in the valley. Groundwater levels are reportedly 22 feet below the surface at the south end of the valley and 90 feet deep in the north-central part of the valley. Hadiaris (1988) concluded that a recharge mound has been created by leakage through the Orr Ditch.

Groundwater quality in Spanish Springs Valley is variable. Some wells in the southern part of the valley have TDS concentrations of 2,000 ppm; sulfate concentrations exceed standards in this area. Water quality improves to the north. A recharge mound created by leakage from the Orr Ditch may form a groundwater divide that protects good-quality water in the north half of the valley from mixing with poor-quality water in the south part of the valley.

3.5 WETLANDS

Wetlands, as used in this EIS, refer to vegetated areas in which the soil or substrate is saturated for all or a portion of the growing season. Wetlands were identified from the *National Wetland Inventory* (NWI) maps provided by the U.S. Fish and Wildlife Service, and supplemented by soil survey information and hydric soil lists prepared by the SCS (1987; 1990). A wetlands survey was conducted by JBR (1990b) along the southeast edge of Honey Lake Valley in February 1990 to identify wetlands that may be regulated by the U.S. Army Corps of Engineers under Section 404 of the Clean Water Act (these are referred to as *jurisdictional* wetlands). A reconnaissance survey of wetlands in the Smoke Creek Desert was conducted in 1990 by JBR (1990a). Field reconnaissance was also conducted by members of the EIS staff in parts of Honey Lake Valley, the Smoke Creek Desert, and along parts of the proposed and alternative pipeline routes.

The single feature that all wetlands have in common is a soil or substrate that is saturated with water during at least a part of the growing season. These saturated conditions control the types of plants and animals that live in these areas. Adamus et al. (1987) identified many valuable functions provided by wetlands, including groundwater recharge and discharge, flood flow alteration, sediment stabilization, sediment/toxicant retention, nutrient removal/transformation, diverse wildlife and aquatic habitats, and recreation.

The identification of wetlands and associated habitats is regulated by complex federal legislation. The U.S. Environmental Protection Agency (EPA), the U.S. Army Corps of Engineers (COE, 1987), and the U.S. Fish and Wildlife Service (FWS), have developed definitions of wetlands in response to their regulatory responsibilities. The following definition of wetlands is the regulatory definition used by the EPA and the COE for administrative permits under Section 404 of the Clean Water Act:

"...those areas that are inundated or saturated by surface or groundwater at a frequency and duration sufficient to support, and that under normal circumstances do support, a prevalence of vegetation typically adapted for life in saturated soil conditions. Wetlands generally include swamps, marshes, bogs and similar areas." (40 CFR 230.3 and 33 CFR 328.3).

The U.S. Fish and Wildlife Service defines wetlands for their *National Wetlands Inventory Program* as follows:

"Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes, (2) the substrate is predominantly undrained hydric soil and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year."

Wetlands are described in this EIS using the classification system developed for the U.S. Fish and Wildlife Service by Cowardin et al. (1979). The NWI maps are based primarily on remote-sensing and aerial photographs, with some field checking. Further evaluation of wetlands identified in this EIS with the aid of the NWI maps would be required as a part of the permitting process under Section 404 of the Clean Water Act to confirm whether these areas would meet regulatory criteria of the U.S. Army Corps of Engineers as *jurisdictional* wetlands.

Wetlands in the affected area consist primarily of *palustrine* wetlands. *Palustrine* wetlands identified on the NWI maps are dominated by plants that persist throughout the year or the growing season. These areas are what most people think of when they see the term "wetland," and include marshes, swamps, bogs and wet meadows. *Palustrine* wetlands may be dominated by trees (*palustrine forested*), shrubs (*palustrine scrub/shrub*), emergent herbaceous plants such as sedges, rushes, grasses, cattails, and bulrushes (*palustrine emergent*), or open-water areas smaller than 20 acres, such as ponds (*palustrine-open water* and *palustrine-unconsolidated shore*). In the affected area, *palustrine* wetlands occur in the vicinity of springs, seeps, and flowing wells, on the floodplains of streams and creeks, around the shores of some lakes and reservoirs, adjacent to irrigation canals, and in areas influenced by irrigation or irrigation runoff.

Riverine systems identified on the NWI maps are open-water habitats. They are not considered to be wetlands in this EIS because they lack vegetation. *Riverine* systems include all open water areas that occur within a defined channel of a stream. In the affected area, *riverine* systems occur along perennial and intermittent stretches of streams and along some major dry washes. The *riverine* systems in the affected area rarely have significant vegetation within the defined channel. In some cases, *riverine* systems are bounded by *palustrine* wetlands that develop in the floodplain on either side of the defined channel. The *riverine* system and the adjacent *palustrine* wetlands are often referred to as "riparian habitat." *Riparian* habitat is described under *Vegetation* and *Wildlife* (Sections 3.6 and 3.7).

Lacustrine systems identified on the NWI maps are also open-water habitats. They, like *palustrine* systems, are not considered to be wetlands in this EIS because they lack vegetation. *Lacustrine* systems include lakes larger than 20 acres. Playas are *lacustrine*

systems because they function as open-water habitat when they are flooded from surface runoff, which may be every winter and spring, or only during years of above average precipitation. Lacustrine systems in the affected area lack vegetation or, in the case of some playas and dry lakes, may be sparsely vegetated with non-wetland-type pioneering vegetation that invades parts of the playa during favorable conditions.

3.5.1 *Pipeline Routes*

The landscapes traversed by the pipeline routes include palustrine wetlands, and riverine and lacustrine systems (Figure 3.5-1). Riverine systems occur along perennial and intermittent stretches of streams and along some dry washes. The riverine systems near the pipeline routes have little or no vegetation component within the channel. However, perennial stretches of some creeks support palustrine wetlands on either side of the channel. These include palustrine scrub/shrub, palustrine forested, and palustrine emergent wetlands. Vegetation in these palustrine wetlands include several species of shrubby willows, wildrose, chokecherry, desert peach, cottonwood and aspen trees, various grasses, mullein, clover, sedges and rushes. Palustrine emergent wetlands commonly occur around springs and seeps near the pipeline routes and include wet meadows and limited areas of emergent vegetation. Vegetation that commonly occurs in these palustrine emergent wetlands includes a variety of grasses, sedges, rushes, duckweed, watercress, buttercup, and monkey-flower. Plant species occurring around several springs and seeps in the vicinity of the pipeline routes are described in JBR (1990a).

• *Proposed Bedell Flat Route*

The route of the proposed water and gas pipelines in Honey Lake Valley would pass 500 feet south of Fish Springs playa, classified as a lacustrine intermittently flooded area (Figure 3.5-1). The pipelines would cross two small washes that drain into Fish Springs playa on their southward ascent out of the valley. These washes are classified as riverine systems containing little or no vegetation. After crossing a low pass between the Fort Sage and Virginia Mountains, the pipelines would cross riverine systems at three forks of Dry Valley Creek. Stream flow in these creeks is intermittent. There are no wetlands adjacent to the stream channel.

The gas pipeline would pass through Warm Springs Valley and cross riverine systems and wetlands on private lands along Hay, Wilcox, and Cottonwood Creeks (Figure 3.5-1). Stream flow in Hay and Wilcox Creeks is perennial, whereas parts of Cottonwood Creek flow intermittently. Hay and Wilcox Creeks support some vegetation such as duckweed and watercress which was confirmed by field reconnaissance. Palustrine wetlands exist along either side of the stream channel in Hay and Wilcox Creeks and along some perennially flowing stretches of Cottonwood Creek. Vegetation in these wetlands consists of willow, cottonwood, various grasses, sedges, rushes, cattail and horsetail.

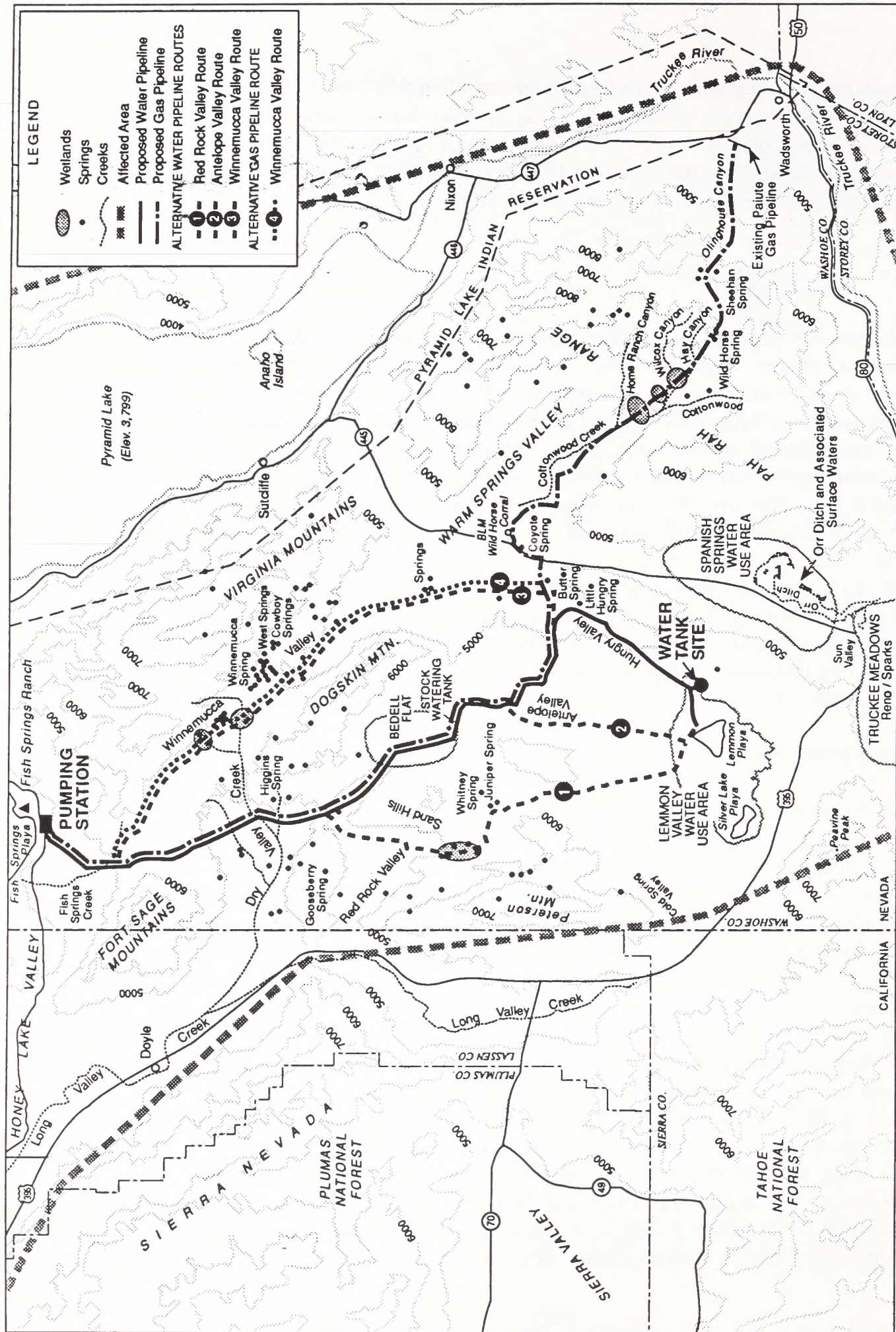


Figure 3.5-1

Wetlands and Riparian Areas along Proposed and Alternative Pipeline Routes



- *Winnemucca Valley Route*

The route of the water and gas pipelines through Winnemucca Valley would cross riverine systems on private lands along the forks of upper Dry Valley Creek, which also support palustrine wetlands on either side of the stream channel (Figure 3.5-1). South of upper Dry Valley Creek, the route would pass through five miles of Winnemucca Valley where springs and seeps are abundant. Much of the lower valley is under irrigation and irrigation ditches support wetlands habitat. The route of the pipelines avoids the wetlands in this area and they are not shown on Figure 3.5-1.

The gas pipeline would cross wetlands at Hay, Wilcox, and Cottonwood Creeks in Warm Springs Valley described under the proposed route.

- *Antelope Valley Route*

In addition to the wetlands and related habitats that would be crossed along the proposed Bedell Flat route, the Antelope Valley route would also pass just west of a small, largely unvegetated playa in Antelope Valley. This playa is classified as a lacustrine system, but not as a wetland. It is not shown on Figure 3.5-1.

- *Red Rock Valley Route*

The route of the water pipeline through Red Rock Valley would cross one intermittent stream that supports a riverine system. No wetlands occur adjacent to this channel crossing.

Numerous springs, seeps, creeks, and pools occur along a two-mile stretch of the water pipeline route in southern Red Rock Valley. This area supports palustrine emergent, palustrine scrub/shrub and palustrine open-water wetlands. Vegetation consists of large areas of wet meadows and emergent herbaceous vegetation such as cattail and bulrush. Along stretches of small creeks supported by spring flow, vegetation consists of willow, wildrose, grasses and emergent herbaceous plants.

The gas pipeline would cross wetland habitat along Hay, Wilcox, and Cottonwood Creeks in Warm Springs Valley described under the proposed route, as well as the wetland habitats in upper Dry Valley Creek described under the Winnemucca Valley route.

3.5.2 Water Source Area

The water source area contains several large areas of open-water habitat and some wetlands. Wetlands on the valley floors are shown on Figure 3.5-2. Honey Lake (shown on Figure 3.1), Fish Springs playa, and the playa in Smoke Creek Desert comprise the majority of the lacustrine systems in the water source area. Wetlands, as well as these major open-water systems, are discussed below.

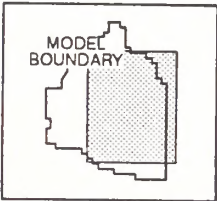
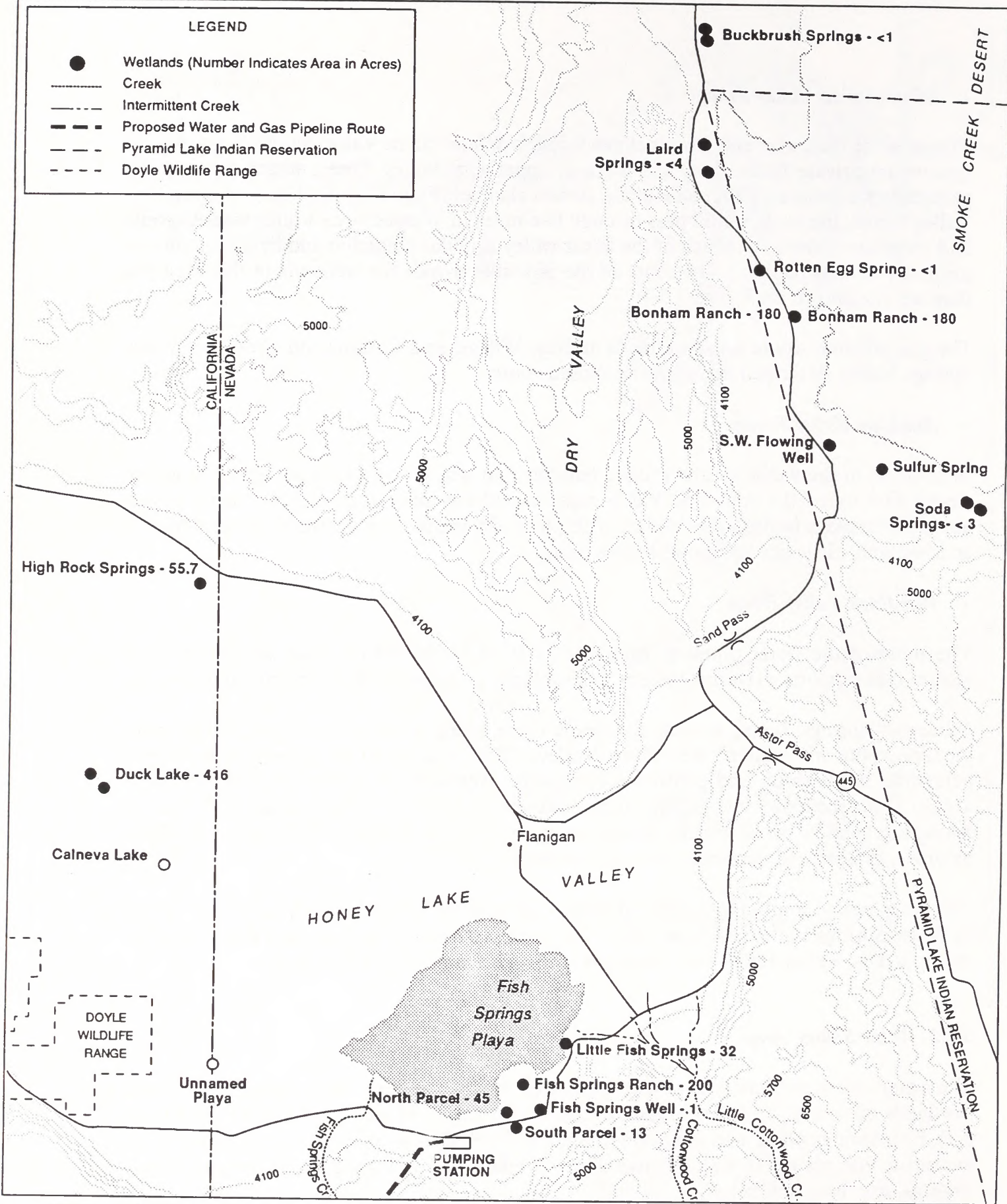
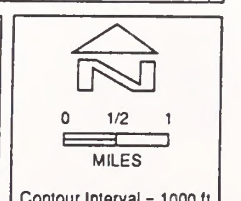


Figure 3.5-2

Location of Wetlands in the Water Source Area



- *Little Fish Springs*

Little Fish Springs contains 32 acres of palustrine emergent wetlands that rely partly on surface runoff from Cottonwood Creek and groundwater discharge at Little Fish Springs. The dominant vegetation is arctic rush and salt grass. Little Fish Springs flows at the surface only during wet years. The *National Wetlands Inventory* map shows a water regime of seasonally flooded for this area. The site, located on private land, has been heavily grazed.

- *Fish Springs Playa*

Fish Springs playa is a lacustrine system with a water regime of intermittently flooded (*National Wetlands Inventory* maps). It is flooded in some years from surface runoff during large storms. The playa is bare of vegetation, except around its edges where non-wetland-type pioneering vegetation can grow during favorable conditions. The dominant vegetation is salt grass, which occurs primarily around the edge of the playa. Based on its lack of vegetation, Fish Springs playa is not considered a wetland. A portion of the playa was evaluated to determine if it met COE criteria as a jurisdictional wetland, using the 1989 COE manual (Federal Interagency Committee for Wetland Delineation, 1989). It failed to meet jurisdictional criteria for wetland vegetation and soils (JBR, 1990b).

- *Fish Springs Ranch*

Flood-irrigated pastures at Fish Springs Ranch contain 200 acres of palustrine emergent wetlands. The dominant shrubs are Australian saltbush, black greasewood, and rubber rabbitbrush. The dominant grasses and grass-like plants are arctic rush, salt grass and spike bentgrass. Parts of this pasture are heavily grazed. The *National Wetlands Inventory* map depicts a water regime of seasonally flooded for this wetland.

The well at Fish Springs Ranch supports 0.1 acres of wetlands. Vegetative cover is sparse and dominated by fowl mannagrass. This area is not identified on the *National Wetlands Inventory* maps.

- *North and South Parcels*

Palustrine emergent wetlands are identified on the *National Wetlands Inventory* map within a 13-acre parcel south of Fish Springs Ranch road and a 45-acre parcel north of the road. Vegetation in these areas is dominated by arctic rush and salt grass. Both parcels are grazed by livestock.

- *Cottonwood Creek*

Cottonwood Creek, located three miles east of Fish Springs Ranch, represents a typical riverine system. The upper reaches of Cottonwood Creek have perennial flow, and the middle and lower reaches have intermittent flow. Most of the lower channel is unvegetated or is occupied by pioneering vegetation. Where streamflow is perennial, emergent vegetation such as rush, cattail, horsetail, watercress, and duckweed are common. Palustrine

emergent, scrub/shrub, and tree wetlands occur on either side of the channel. The vegetated portions of the stream channel and the adjacent palustrine areas constitute wetlands.

- *Calneva Lake*

Calneva Lake, eight miles northwest of Fish Springs Ranch, is a playa covering 150 acres, and is classified as a lacustrine system on the *National Wetlands Inventory* map. It is intermittently flooded by surface runoff from snowmelt and large storms. During field reconnaissance in December of 1991 it had no persistent vegetation, but there was standing water occupying 25 percent of the playa's surface. Based on the lack of vegetation, Calneva Lake is not considered a wetland.

- *Duck Lake*

Duck Lake is classified as a palustrine emergent wetland that is seasonally flooded (*National Wetlands Inventory* maps). It consists of about 415 acres of gently-rolling hills which contain small bodies of standing water during periods of inundation. During field reconnaissance in December of 1991, Duck Lake was covered with vegetation, dominated by rushes. During field reconnaissance in April 1992, the lake was dry and the vegetation was completely absent. Duck Lake is located at the terminus of Skedaddle Creek, which is the lake's primary source of water.

- *Unnamed Playa*

An large unnamed playa six miles west of Fish Springs Ranch is classified as a littoral lacustrine system of about 80 acres. The *National Wetlands Inventory* map shows a water regime of temporarily flooded. The source of periodic flooding is surface runoff. The playa is mostly unvegetated except for salt grass around the edges, and is not considered a wetland.

- *Honey Lake*

Honey Lake is the most prominent open-water habitat in Honey Lake Valley (Figure 3-1). The surface area of the lake fluctuates seasonally and has dried up almost a dozen times since 1859 (Rockwell, 1990). On average, however, Honey Lake encompasses 47,000 acres with a volume of 120,000 acre-feet (Handman et al., 1990). The *National Wetlands Inventory* map depicts its water regime as temporarily flooded. Honey Lake was completely dry following the recent drought, but was partly filled in 1993 from unusually heavy winter storms. Lands adjacent to Honey Lake contain a variety of wetlands including palustrine emergent wetlands, palustrine scrub/shrub wetlands, palustrine unconsolidated shore wetlands, and palustrine forested wetlands.

- *High Rock Spring*

This site contains 42 acres of palustrine emergent wetlands. Water from High Rock Spring is used to irrigate fields at High Rock Ranch. The irrigation ditches support an additional

13.7 acres of palustrine emergent and scrub/shrub wetlands. Water regimes include temporarily flooded and seasonally flooded due to irrigation return flows at the ranch.

- *Smoke Creek Desert*

The playa in the Smoke Creek Desert consists of 23,000 acres that are classified as a lacustrine system. The playa is intermittently flooded and largely bare of vegetation. It is not considered to be a wetland. Along the western and southern edge of the playa are 195 acres of palustrine wetlands that occur around springs, seeps, and naturally flowing wells (Figure 3.5-2). The largest of these wetlands, encompassing 180 acres, are at Bonham Ranch. Smaller wetlands occur at Rotten Egg Spring, Laird Springs, Buckbrush Springs, Soda Springs, and at several other springs and flowing wells scattered along the southwest perimeter of the playa. The most prominent of these wetlands are discussed below.

Bonham Ranch

Bonham Ranch is an uninhabited, privately owned ranch on the western edge of the Smoke Creek Desert about 13 miles northeast of Fish Springs Ranch. The area contains approximately 180 acres of palustrine emergent and palustrine open-water wetlands that are supported by flowing wells, springs, and near-surface groundwater. Vegetation at the site consists of wet meadow and emergent vegetation including saltgrass, sedges, rushes, cattail, bulrush and horsetail. Several planted cottonwoods and willows occur around the old ranch buildings.

The combined flow rate of the four naturally flowing wells at the ranch is 450 gpm or 730 acre-ft/yr (JBR, 1990a). If the evapotranspiration rate from this wetland is assumed to be four feet per year, then approximately 720 acre-ft/yr are needed to maintain this wetland. Therefore, this wetland is probably maintained largely by well discharge rather than spring discharge. Detailed studies of the water budget at Bonham Ranch have not been conducted.

Rotten Egg Spring

Rotten Egg Spring is located about one mile north of Bonham Ranch on the western edge of the Smoke Creek Desert. About 1.0 acre of palustrine emergent wetlands supported by spring flow occurs at the site.

Laird Springs

The Laird Springs complex is located about 2.5 miles north of Bonham Ranch. Flowing springs at the site support about 4.0 acres of palustrine emergent wetlands consisting of grasses, rushes, cattail and bulrush.

Buckbrush Springs

The Buckbrush Springs complex is located about four miles north of Bonham Ranch. A flowing well at the site supports about 1.0 acre of palustrine emergent wetlands.

Soda Springs

Soda Springs is located about four miles south of Bonham Ranch and supports about 2.3 acres of palustrine emergent wetlands.

Other Wetlands in the Southwestern Smoke Creek Desert

Several other small and isolated areas of palustrine emergent wetlands occur along the southwestern edge of the Smoke Creek Desert. These wetlands are associated with naturally flowing wells, springs, and seeps. Combined, they account for about 9.0 acres. Only S.W. Flowing Well and Sulfur Spring are shown on Figure 3.5-2.

- *Terraced Hills*

The Terraced Hills north of Pyramid Lake support approximately 127 acres of lacustrine littoral and unconsolidated shore systems (Figure 3-1). The hydrology of these areas is related to the fluctuating shoreline of Pyramid Lake. These shorelines are largely bare of vegetation and thus do not constitute wetlands.

3.5.3 *Delivery/Use Area*

Wetlands in the delivery/use area are concentrated in Spanish Springs Valley, where about 1,300 acres of wetland and riparian vegetation have developed in response to leakage and irrigation practices associated with the Orr Ditch (Washoe County, 1991a; SEA et al., 1991). The *National Wetlands Inventory* maps identify primarily palustrine emergent and palustrine open water wetlands in these areas. Plant species include cottonwood, willow, cattail, and a variety of grasses and forbs that are adapted to moist soils.

No substantial areas of wetland habitat occurs in Lemmon Valley (Washoe County, 1991b). Isolated areas of shallow groundwater bordering Lemmon playa support saltgrass meadows. Lemmon playa is a lacustrine system that is seasonally flooded from surface runoff during large storms. The playa is largely barren and thus does not constitute a wetland. Minor areas of wetland vegetation have developed where wastewater from the Reno-Stead treatment facility is discharged to Lemmon playa via an unnamed ditch.

3.6 *VEGETATION*

Plant species discussed in this section are referred to by their generally accepted common names. Appendix D lists the scientific names. Common and scientific plant names are from Kartesz (1988) and Munz and Keck (1968).

3.6.1 Pipeline Routes

Figure 3.6-1 shows the proposed and alternative water and gas pipeline rights-of-way and the vegetation types that exist along them. The map was developed from vegetation surveys along the pipeline rights-of-way (JBR, 1989; 1990c), and supplemented by soil descriptions from the U.S. Soil Conservation Service (SCS; no date; SCS, 1983) and recent Ecological Site Descriptions for the area (SCS, 1983).

The vegetation aspect along the pipeline routes is shrub-dominated. The majority of the routes are within sagebrush shrub communities. The dominant shrub in these communities is one or more species of sagebrush--mountain big sagebrush, Wyoming big sagebrush, basin big sagebrush, or low sagebrush, depending upon the elevation, depth of soils, and exposure. Antelope bitterbrush is an important sub-dominant shrub within many of the sagebrush vegetation types shown on Figure 3.6-1. Bitterbrush is an important big game browse species. Other sub-dominant shrubs within the sagebrush communities include desert peach, ephedra, littleleaf horsebrush and spiny hopsage. Cool-season perennial grasses include bluebunch wheatgrass, needlegrass, Idaho fescue, Indian ricegrass, and squirreltail. The understory is composed of cool-season forbs such as Indian paintbrush, arrowleaf balsamroot, mulesear wyethia, phlox and wild buckwheat. Scattered junipers occur near a few isolated sections of the routes above elevations of 6,000 feet. Several miles of the routes are within sagebrush communities that have been altered by range fires within the last 40 years. Burned areas generally support a heavy growth of cheatgrass, a non-native annual grass that readily invades after wildfires. Shrub regeneration in the burned areas varies according to the number of years since the burn.

Lower-elevation portions of the routes (generally below 4,500-feet) support salt desert shrub communities. The dominant shrub in this community is shadscale, generally occurring in association with Bailey's greasewood and budsage as co-dominants. The understory consists of mixed cool- and warm-season grasses and forbs such as globemallow, prince's plume and wild buckwheat. Moister sites within the salt desert shrub community, usually exhibiting a seasonally high water table, support black greasewood and saltgrass.

No riparian and wetland habitats occur along the proposed rights-of-way on public land. Some riparian and wetland habitats occur on private land along portions of Hay, Wilcox, and Cottonwood Creeks. The riparian habitat in these areas consists of willows, wild rose and stands of cottonwood trees and a variety of grasses and forbs. Wetland habitat consists of rushes, sedges, cattails and horsetails that occur in the narrow floodplain on both sides of these streams. Watercress and duckweed occur within the stream channel.

Portions of the pipeline routes within Winnemucca Valley, Red Rock Valley and Honey Lake Valley are adjacent to cropland (the primary crops are alfalfa and hay) and irrigated pasture. Near the end of the water pipeline in Lemmon Valley, the route is within areas of urban and suburban development.

Table 3.6-1 summarizes the approximate mileage along the proposed and alternative pipeline segments for each major vegetation community--big sagebrush, low sagebrush, salt desert shrub and agricultural/urban land. Table 3.6-1 also lists the mileage along each

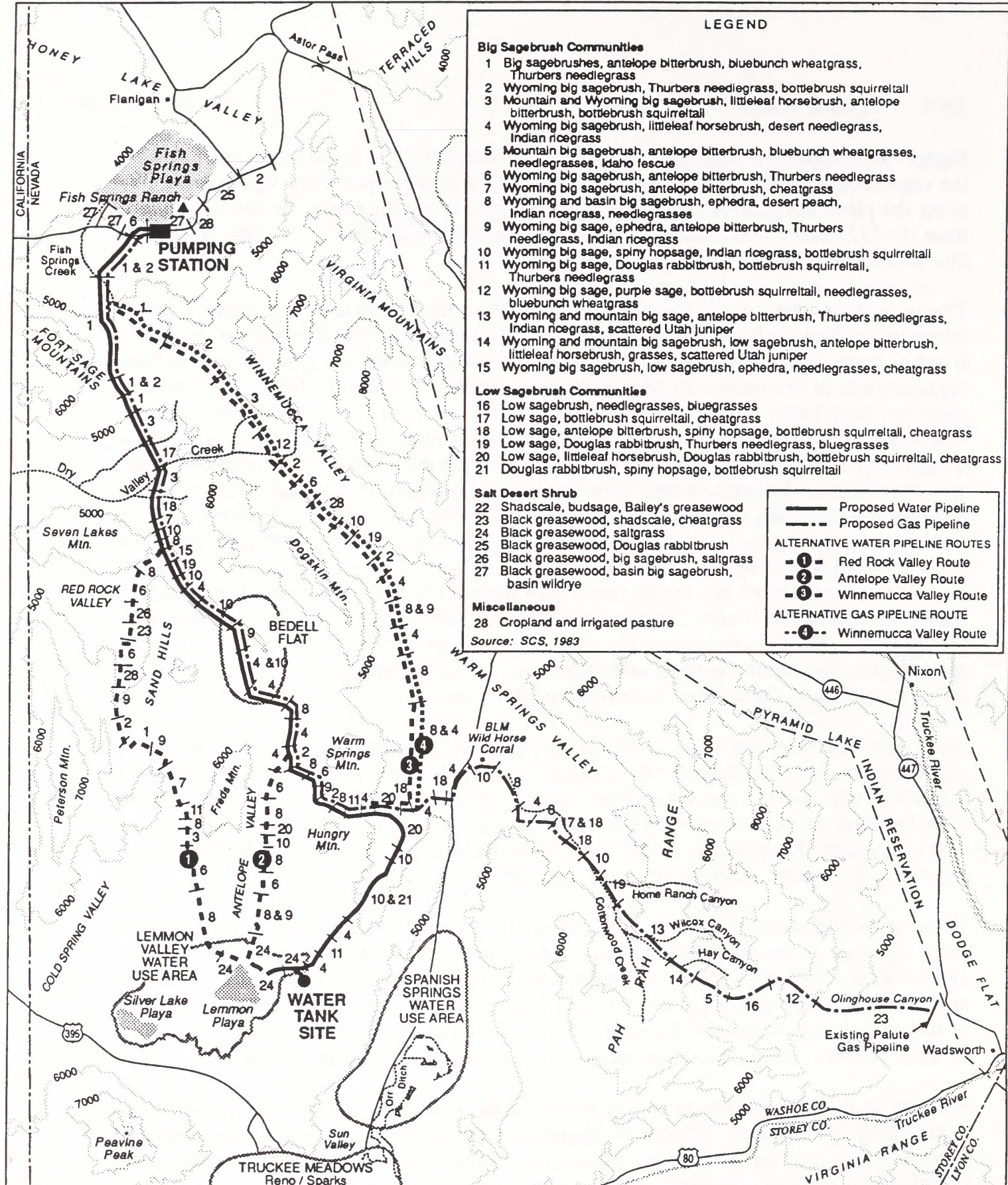


Figure 3.6-1

Vegetation Along Proposed and Alternative Pipeline Routes

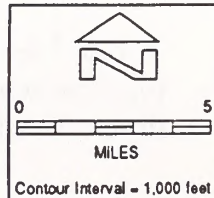


TABLE 3.6-1

MILEAGE ALONG ROUTE SEGMENTS WITHIN EACH MAJOR VEGETATION COMMUNITY

Vegetation Community	Miles of Route				
	Proposed Water Pipeline Route ^(a)	Gas Pipeline Segment ^(b)	Red Rock Valley Segment	Antelope Valley Segment	Winnemucca Valley Segment
Big Sagebrush	32	17.5	16.5	7	22
Low Sagebrush	6	7	0	0.7	1
Salt Desert Shrub	8	5	3.5	1.8	0
Agricultural and Urban Land	2	0	1	0	1.5
Sagebrush/Bitterbrush Component ^(c)	(10)	(8)	(9)	(2)	(5)
Total Mileage ^(d)	48	29.5	21	10	24.5

^(a) This refers to the proposed water pipeline route across Bedell Flat from the well field in Honey Lake Valley to the pipeline terminus in Lemmon Valley. It includes approximately a nine-mile segment of pipe that connects the well field to the main pumping station.

^(b) The segment of the proposed gas pipeline route from the existing gas pipeline near Wadsworth to the junction with the proposed water pipeline route.

^(c) The Sagebrush/Bitterbrush Component refers to the several big and low sagebrush vegetation types that have antelope bitterbrush as a significant sub-dominant shrub species.

^(d) Although the Sagebrush/Bitterbrush Component is distinguished separately, the mileage within this component is accounted for in the total within the mileage attributed to the big and low sagebrush communities. Therefore, total mileage along the right-of-way is the sum of disturbance to the big sagebrush, low sagebrush, and desert salt shrub communities and agricultural and urban lands.

segment that includes antelope bitterbrush as an important co-dominant shrub within the community. Antelope bitterbrush is of special concern because of its value as a browse species for mule deer (Section 3.7). The following sections briefly describe the vegetation along the proposed pipeline routes and the alternative route segments.

Proposed Route of Water Pipeline

Approximately 80 percent of the water pipeline route is within sagebrush vegetation communities, 17 percent is in salt desert shrub communities, with the remainder in agricultural and urban land (Table 3.6-1). The route leaves Honey Lake Valley via a low summit between the Fort Sage and Virginia Mountains. Antelope bitterbrush is an important component of the vegetation along this segment of the route. The route crosses three main forks of Dry Valley Creek and proceeds over a low pass before entering Bedell Flat. The vegetation along this segment is dominated by low sagebrush. Some areas within Bedell Flat that have been affected by fire and were reseeded in the mid-1980s with crested wheatgrass.

The proposed route leaves Bedell Flat via a low pass, crosses the upper part of Antelope Valley and enters Hungry Valley via another low pass. This segment of the route supports big sagebrush vegetation types (Figure 3.6-1). Through Hungry Valley, the water pipeline route is within areas of low sagebrush and Wyoming big sagebrush vegetation types. Within Lemmon Valley, portions of the route are in a salt desert shrub vegetation type consisting of black greasewood and saltgrass. Near its end in Lemmon Valley, the pipeline route passes through areas of suburban development.

- *Proposed Route of Gas Pipeline*

About 83 percent of the gas pipeline route from Dodge Flat to its intersection with the water pipeline route in northern Hungry Valley is within sagebrush communities; the remainder is in salt desert shrub communities (Table 3.6-1).

The initial 3.5 miles of the route near Wadsworth to Olinghouse Canyon supports a salt desert shrub vegetation community that consists primarily of shadscale. Within Olinghouse Canyon, vegetation along the route consists of a sagebrush, needlegrass and bluebunch wheatgrass type. Where the route crosses the higher ridges of the Pah Rah Range it passes through low sagebrush vegetation types consisting of low sagebrush, needlegrasses and bluegrasses. The route descends the western slope of the Pah Rah Range and enters the Cottonwood Creek drainage. Vegetation along this portion of the route consists of mountain and Wyoming big sagebrush along with antelope bitterbrush, ephedra, and scattered Utah juniper. In the upper Cottonwood Creek drainage, riparian vegetation consisting of cottonwoods and willows occurs along the creek. The proposed pipeline route avoids the riparian vegetation zone along the creek, with the exception of one crossing, and is within the mixed big and low sagebrush communities above the creek. The route crosses riparian areas in Hay, Wilcox, and lower Cottonwood Creeks. It then crosses further downstream, Warm Springs Valley to upper Hungry Valley, where it joins the proposed water pipeline route (Figure 3.6-1). Vegetation within this last segment of the route consists of interspersed big and low sagebrush vegetation types.

- *Winnemucca Valley Alternative Segment*

The Winnemucca Valley segment is 24.5 miles long. The vegetation along the route within upper Warm Springs Valley and lower Winnemucca Valley consists of big and low sagebrush communities. Littleleaf horsebrush and spiny hopsage are also characteristic shrubs in this area. Segments of the route within Winnemucca Valley are adjacent to crop and pasture lands. Antelope bitterbrush is an important component of the big sagebrush vegetation at the pass between the Fort Sage and Virginia Mountains. Riparian vegetation, consisting of shrubby willows, wildrose and several species of grasses and emergent vegetation, occurs along this route in the area of upper Dry Valley Creek where flow is perennial.

- *Antelope Valley Alternative Segment*

The Antelope Valley segment is 10 miles long. Vegetation along this route consists of Wyoming and basin big sagebrush with spiny hopsage, ephedra, desert peach and some antelope bitterbrush. Grasses include bottlebrush squirreltail, Thurbers needlegrass and

cheatgrass. At its end, the route enters a residential area of Lemmon Valley. No wetland or riparian vegetation occurs along the Antelope Valley segment.

- *Red Rock Valley Alternative Segment*

The Red Rock Valley segment is 21 miles long. Seventy nine percent of the route is within big sagebrush and sagebrush/bitterbrush vegetation communities. Near the southern end of the route, the sagebrush/bitterbrush communities have been altered by past fires; vegetation in these areas consists primarily of cheatgrass and Douglas rabbitbrush. Some regeneration of sagebrush has occurred, but little regeneration of bitterbrush is evident. Near the route's end in Lemmon Valley, vegetation consists primarily of black greasewood and saltgrass.

Numerous springs, pools, and creeks occur along a two-mile segment at the southern end of Red Rock Valley. The water supports both wet meadow type wetlands, consisting of sedges, rushes, grasses, cattails and bulrushes, and shrubby riparian vegetation consisting mostly of willows and wildrose.

3.6.2 *Water Source Area*

The *water source area* encompasses eastern Honey Lake Valley and surrounding uplands and a portion of the adjacent Smoke Creek Desert. This section describes the vegetation within the water source area to establish a baseline for the discussion of potential effects to vegetation from planned groundwater withdrawals. The major vegetation communities within the area are described as well as their water supply requirements and reliance on groundwater.

- *Vegetation Communities*

The distribution of vegetation within the water source area is controlled primarily by a combination of hydrologic and soil factors. For discussion purposes, the vegetation types in the water source area are separated into two categories: (1) vegetation of the mountains and adjacent alluvial slopes, and (2) vegetation within the basin and valley floors. Vegetation in the uplands is generally adapted to low soil salinity and is capable of relying entirely on stored soil moisture from precipitation. From the uplands to the basin floor, there is an increasing gradient of soil salinity and a decreasing gradient of soil particle size. Large areas of the basin floors exhibit a permanent or seasonally high groundwater table. Plant species on the basin floors are adapted to high soil salinity and pH and many species rely on groundwater for at least a portion of their annual water requirements. Such plants are termed *phreatophytes*.

Big and low sagebrush communities predominate in the uplands. Juniper and pinyon pine occur within the upper-most sagebrush uplands. On the dry lower slopes, sagebrush communities transition to a shadscale community that is tolerant of the increasing soil salinity and aridity. On the basin floors that exhibit a seasonally high groundwater table, the shadscale community gradually changes to a black greasewood community. Black

greasewood is one of several phreatophytes that occur on the basin floors. In the lowest part of the basins near playas, vegetation consists of a desert sink type that is comprised of several phreatophytic plants that are adapted to high soil salinity and pH.

The following descriptions of the major vegetation communities within the water source area are based on field studies (JBR, 1989; 1990c) supplemented with Ecological Site Descriptions from the Soil Conservation Service. Figure 3.6-2 presents a generalized vegetation map of the water source area. Each major vegetation community delineated on Figure 3.6-2 is composed of one or more distinct vegetation types that are grouped together based on similarities in water requirements and degree of reliance upon groundwater. Appendix D presents the scientific names for plant species referred to in the text and summarizes the ecological sites included within each of the major vegetation communities.

Big and Low Sagebrush Uplands

The upland sagebrush community occurs in the mountains, foothills and upper alluvial fans on the north, south and east sides of the water source area, where precipitation exceeds eight inches annually. It occupies 191,000 acres within the water source area. Sagebrush occurs on a wide variety of soils, but is not tolerant of saline or alkaline soils (Gates et al., 1956; Fautin, 1946; Miller et al., 1982). Plant species in the sagebrush community derive all of their water requirements solely from precipitation stored as soil moisture and do not rely upon groundwater for any of their water requirements (Miller et al., 1982; Branson et al., 1976; LADWP and Inyo County, 1991; Robinson, 1958; Fautin, 1946). The groundwater table is at least several hundred feet below the ground surface in these areas.

The sagebrush uplands are dominated by sagebrush--mountain big sagebrush, Wyoming big sagebrush, and low sagebrush. Other shrubs include Douglas rabbitbrush, ephedra, desert peach, desert snowberry, and serviceberry. The dominant perennial grasses include Thurbers needlegrass, Indian ricegrass, bottlebrush squirreltail, bluebunch wheatgrass and Idaho fescue. Western and(or) Utah juniper occur with the sagebrush on exposed rocky slopes above 6,500 feet. Curl-leaf mountain mahogany is present on upper slopes and summits. Isolated aspen stands occur on protected, moist soils in the uppermost elevations. These isolated areas of woodland are included in the upland sagebrush community because their reliance on groundwater is similar to the sagebrush uplands community.

Antelope Bitterbrush/Sagebrush Uplands

This vegetation community is distinguished from other sagebrush uplands based on the presence of antelope bitterbrush as a dominant or co-dominant shrub. The community occurs on the slopes of the Fort Sage Mountains in the southern part of the water source area and occupies about 28,000 acres. Antelope bitterbrush requires deep, well-drained soils that are non-saline and non-alkaline (Nord, 1965). Within the water source area, the community occurs in deep soils composed of sands and decomposed granite (SCS Technical Guide IIE; no date). Antelope bitterbrush is not considered a phreatophyte and does not require groundwater to survive (Nord, 1965). The depth to groundwater within the bitterbrush/sagebrush community in the water source area is 50 feet to more than 100 feet.

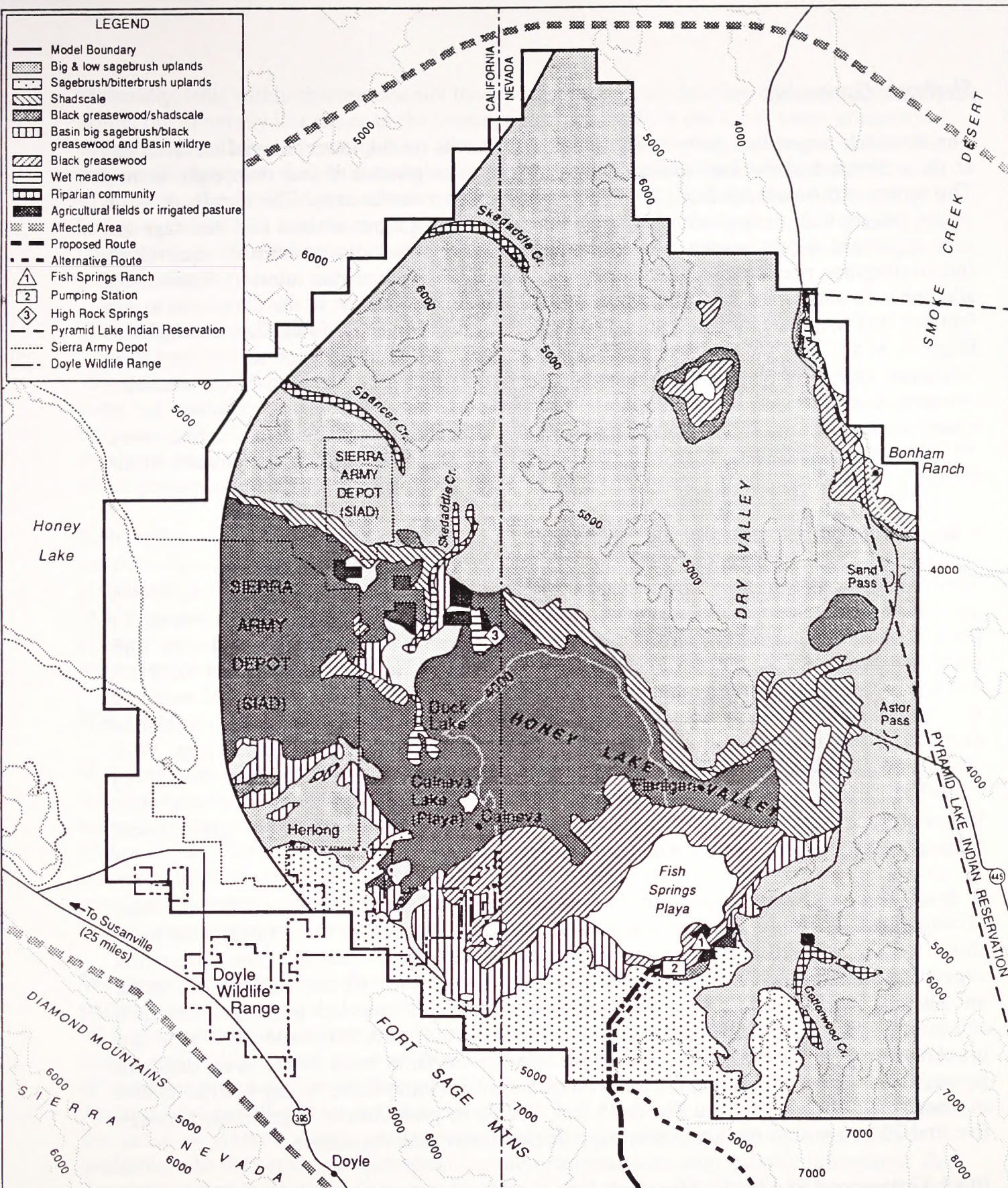
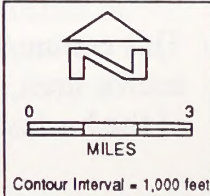


Figure 3.6-2

Vegetation in the Water Source Area



Shadscale Community

The shadscale vegetation community occupies arid soils on the lower alluvial terraces and at the perimeter of the basin floors, where annual precipitation is less than eight inches. The community occurs on about 13,000 acres in the water source area. The dominant shrub within the community is shadscale. Spiny hopsage, Bailey's greasewood and bud sage are also important shrubs within this community. Grasses include bottlebrush squirreltail, Indian ricegrass, needlegrasses and cheatgrass. Shadscale is somewhat tolerant of saline and alkaline soils and generally occurs where soils are moderately saline in the upper one to two feet but may be saline and alkaline at depth (Shantz and Piemeisel, 1940; Gates et al., 1956; Branson et al., 1967; 1976). Shadscale is not adapted to extremely high salinity and does not grow well on excessively saline soils in areas of high groundwater. The shadscale community is extremely drought tolerant and does not depend upon groundwater for its water supply (Billings, 1949; Rickard and Keough, 1968; Branson et al., 1976; Fautin, 1946). The regional groundwater table is from 65 to 95 feet deep beneath this community within Honey Lake Valley.

Black Greasewood Community

The black greasewood community occupies the lower portion of the basin floors, where soils are saline and alkaline, fine-textured, and where soil moisture is supplemented by groundwater. Black greasewood tolerates very fine-textured, saline, alkaline and sodic soils with poor aeration (Shantz and Piemeisel, 1940; Gates et al., 1956; Branson et al., 1967; Miller et al., 1982). Black greasewood is generally restricted to areas where soil moisture is enhanced by a seasonally high groundwater table; however, greasewood does not tolerate saturated conditions throughout the root zone for prolonged periods (Ganskopp, 1966; Groeneveld, 1986). The black greasewood community occupies 14,000 acres within Honey Lake Valley, and about 3,500 acres within the Smoke Creek Desert portion of the water source area. The community consists of almost pure stands of black greasewood. Cheatgrass and saltgrass commonly occur in the understory.

A desert-sink vegetation type occurs in relatively narrow bands (less than 200 feet wide) around playas within the black greasewood community. Its distribution is too limited to be shown on the vegetation map of the water source area (Figure 3.6-2). The desert sink vegetation includes pickleweed, seepweed, and salt grass, which are more tolerant of saline and alkaline conditions than is black greasewood and generally tolerates prolonged saturated soil conditions. Like black greasewood, species of the desert sink vegetation type are phreatophytes (Robinson, 1958). Based on information from wells in the area, depth to groundwater within the black greasewood community in Honey Lake Valley is 20 to 25 feet in most areas, but ranges from five to 35 feet. Depth to groundwater is generally between five and 20 feet within the areas that support the desert sink vegetation.

Black Greasewood-Shadscale Community

This community occupies 49,500 acres within the Honey Lake Valley portion of the water source area, in a broad transition zone between the shadscale community on the margins of the basins and the black greasewood community on the lowest portion of the basin floor.

Generally, soils within this community have a high clay or silt fraction and are moderately saline, but generally less saline in the upper profile than soils in the lower black greasewood community. This community also exhibits a seasonally high groundwater table that presumably supports the phreatophytic black greasewood. Based on information from wells in the area, the depth to groundwater within the black greasewood-shadscale community is between 20 and 35 feet in most places. The black greasewood within this transitional community is believed to be obtaining at least a portion of its water requirements from groundwater.

Basin Big Sagebrush-Black Greasewood-Basin Wildrye Community

This community, like the black greasewood-shadscale community, occurs within a transition zone between the black greasewood community on the basin floor and the big sagebrush uplands above. The community occupies 7,500 acres of the water source area on the southern edge of Honey Lake Valley. Characteristic species include basin big sagebrush, black greasewood and basin wildrye.

Soils within this community are not saline in the near-surface horizons and therefore can support big sagebrush. Run-off from the mountains provides additional moisture for plant growth (SCS Technical Guide IIE; no date). The groundwater table within this community in Honey Lake Valley is at depths between 20 and 40 feet from the surface. Both black greasewood and basin wildrye are known to depend on groundwater for a portion of their water supply (Robinson, 1958).

Wet Meadow Communities

Wet meadows occur in both the uplands and basins of the water source area where soils are wet for a major portion of the growing season. There are several small meadows in the uplands of the water source area that are one to a few acres in extent, too small to show on Figure 3.6-2. These upland meadows are associated with springs and seeps and riparian corridors (described below) along stretches of perennial streams. Species of the upland meadows include a variety of perennial grasses and grass-like plants such as tufted hairgrass, bluegrasses, sedges and rushes, and forbs such as cinquefoil, buttercup and horehound.

Wet meadows on the basin floors are associated with springs and seeps, irrigated crop and pasture land, and areas that are seasonally inundated. Areas of wet meadows greater than 10 acres in extent are shown on Figure 3.6-2. Seasonal meadows consisting primarily of sedges and Baltic rushes, occur at Duck and Calneva Lakes in Honey Lake Valley. Both of these lakes accumulate surface runoff; Duck Lake is the terminus of Skedaddle Creek. Accumulated runoff creates saturated conditions in the late winter and spring that supports the meadow grasses, sedges and rushes. Vegetation persists as long as soil moisture is available. In wet years, the seasonal meadow communities may persist throughout the growing season; in dry years they may be gone by mid-spring. During the exceptionally dry 1991/92 winter/spring, for example, Duck Lake supported an extensive stand of rushes in December and January, but was dry and completely barren of vegetation by April.

Wet meadows and areas of wetlands also occur at Fish Springs Ranch and High Rock Ranch, supported by irrigation runoff from adjacent crop and pasture lands. Wet meadows at Fish Springs Ranch support arctic rush, salt grass and spike bentgrass. Approximately 258 acres of wet meadow exists at Fish Springs Ranch, which is mostly grazed. At High Rock Ranch, approximately 58 acres of similar wet meadows exist, supported by irrigation flows from High Rock Spring.

Wet meadows and wetlands also occur in the Smoke Creek Desert at Bonham Ranch, Rotten Egg Spring, Laird Springs, Buckbrush Springs, Soda Springs, and at several small springs and seeps scattered along the southwest perimeter of the playa. These wetlands are supported by flowing springs and wells. Plants at these wetlands consist of sedges, rushes, saltgrass and wetland emergent vegetation such as cattails and bulrushes.

Riparian Communities

Riparian areas occur along stretches of perennial streams where underflow from the streambed maintains a high water table and moist soil. Riparian areas are limited primarily to the mountains, where some stream segments are perennial. The major riparian communities within the water source area are shown on Figure 3.6-2 and include sections of Skedaddle Creek, Spencer Creek and Cottonwood Creek. Plant species within these riparian communities consist of aspen or cottonwood, willow, wildrose, chokecherry, serviceberry, horehound, mullein, dock and several species of perennial grasses. At High Rock Ranch, limited riparian vegetation consisting of willows, scattered cottonwoods, and Russian olive trees occur along irrigation ditches.

Agricultural Fields

Approximately 2,800 acres in the water source area are in agricultural use, including irrigated pasture, irrigated cropland, and old agricultural fields that do not support native vegetation. The primary crop in the area is alfalfa hay. Approximately 1,400 acres of pasture and crops are under irrigation at Fish Springs Ranch. About 1,400 acres of agricultural land and old fields occur in the vicinity of High Rock Ranch.

Playas

Playas occur in the lowest parts of the valleys, where runoff accumulates and evaporates. Playas can have standing water in wet seasons, but are dry most of the year. Soils in the playas are extremely fine-textured and the upper profile is too saline to support plant life. The largest playas are near Fish Springs Ranch and in the Smoke Creek Desert. Smaller playas in the area include Calneva Lake and several unnamed playas (Figure 3.6-2).

• Reliance of Vegetation on Groundwater

Vegetation communities within the water source area can be separated into three categories based on their water requirements: (a) those that rely solely on moisture from precipitation and do not require groundwater, (b) those that rely on groundwater for at least a portion

of their annual water requirements, and (c) those that require saturated soils throughout the rooting zone for the majority of the growing season.

Vegetation communities that do not require groundwater

The sagebrush uplands, antelope bitterbrush/sagebrush and shadscale vegetation communities derive all of their water requirements solely from precipitation stored as soil moisture and do not depend upon groundwater for any portion of their annual water requirements (White, 1932; Miller et al., 1982; Branson et al., 1976; LADWP and Inyo County, 1991; Rickard and Keough, 1968; Fautin, 1946). These vegetation communities occur within the uplands and alluvial fans of the water source area, where the groundwater table is well out of reach of the rooting zone. The depth to groundwater beneath the sagebrush and antelope bitterbrush/sagebrush communities in the water source area is in excess of 100 feet. The depth to groundwater in the areas of pure shadscale within the water source area is generally between 50 and 100 feet.

Vegetation communities that rely on groundwater for at least a portion of their annual water supply

Plant species that rely on groundwater for a portion of their water requirements are referred to as facultative phreatophytes (LADWP and Inyo County, 1991). The primary facultative phreatophyte within the water source area is black greasewood, which occurs over large areas of the valley floors where there is a seasonally high groundwater table. Other facultative phreatophytes include a phreatophytic variety of rabbitbrush, basin wildrye, seepweed, pickleweed, and saltgrass. Three vegetation communities within the water source area contain facultative phreatophytes--the black greasewood community, the black greasewood-shadscale community, and the basin big sagebrush-black greasewood-basin wildrye community.

Many phreatophytic shrub species such as greasewood have both an extensive shallow root system that obtains soil moisture stored from precipitation in the upper soil profile, and a deeper root system that is capable of reaching moisture derived from groundwater (White, 1932; Groeneveld, 1989). There is evidence that greasewood and other shrubby phreatophytes preferentially use shallow soil moisture derived from precipitation and rely on groundwater only when this source of moisture is depleted (White, 1932; Branson et al., 1976). In years of above average precipitation, plants may draw on groundwater sources only minimally. The deep roots of shrubby phreatophytes do not usually extend into the groundwater table, but rather derive moisture from the moist capillary zone above the groundwater table (White, 1932; Robinson, 1958; Harr and Price, 1972). The capillary zone is the layer immediately above the groundwater table into which water rises by capillary action (Fetter, 1980). The capillary zone may extend only a few inches above the groundwater table in coarse-grained soils to as much as 15 feet in fine-textured clays and silts such as those that occur in Honey Lake Valley (Fetter, 1980).

Among the species of facultative phreatophytes within the water source area, black greasewood is by far the most prevalent. Black greasewood is almost always associated with at least a seasonally high groundwater table, but the depth to groundwater over its range

varies widely. Greasewood often occurs where groundwater is within 15 feet of the surface; it also occurs where groundwater is greater than 20 feet and it has been reported from areas where groundwater was more than 40 feet deep (Meinzer, 1927; Harr and Price, 1972; Romo, 1985). Where black greasewood occurs in the water source area, it is using groundwater for a portion of its water requirements. In most areas within Honey Lake Valley where black greasewood communities occur, depth to groundwater is less than 25 feet. It also occurs as a co-dominant with shadscale and sagebrush where depth to groundwater is 35 to 40 feet.

Other species of facultative phreatophytes in the water source area generally require shallower groundwater. Pickleweed and seepweed are reported to occur in areas where groundwater is within one to 20 feet, and four to 15 feet, respectively, of the surface (Robinson, 1958). Salt grass generally requires groundwater no deeper than 15 feet (Robinson, 1958; White, 1932). These species occur in the water source area around the perimeter of playas, where groundwater is between five and 20 feet from the surface. Basin wildrye occurs in areas where groundwater is within 12 feet of the surface (Robinson, 1958). However, it occurs in parts of the water source area where depth to groundwater is between 25 and 40 feet. It may be using infiltrated surface run-off from the adjacent uplands (SCS, Technical Guide IIE).

Several species of trees and shrubs, most notably cottonwood and willow that occur in riparian habitats, are also phreatophytes. These species have deep tap roots that may extend 35 feet below the surface (Robinson, 1958). The primary source of moisture for riparian species is streamflow infiltration. Trees at ranch sites generally depend on irrigation.

Vegetation dependent upon standing water or continuously moist soils

The wet meadow communities and wetlands require saturated soil conditions for the majority of the growing season. Seasonal wet meadows at Duck and Calneva Lakes are supported by accumulated surface runoff. Wet meadows and wetlands at Fish Springs Ranch and High Rock Ranch are supported by irrigation runoff, and thus rely indirectly on groundwater. Wet meadow and wetlands communities in the Smoke Creek Desert also rely upon groundwater flow from springs and flowing wells. Upland meadow communities can be supported by streamflow or by groundwater that is not derived from the regional groundwater system in Honey Lake Valley.

3.6.3 Delivery/Use Area

- *Lemmon Valley*

A large playa exists in the southwest portion of the valley that is bare of vegetation. Surrounding the playa, natural vegetation consists of a salt desert shrub type, with black greasewood and salt grass in areas of moderately to strongly saline and alkaline soils with a seasonally high groundwater table (SCS, 1983). Limited areas of wet meadow with

saltgrass and wetland habitat occur around the playa. A shadscale vegetation community occurs on the valley floor away from the seasonally high groundwater table.

On the upper alluvial fans and terraces to the east and north of Lemmon Valley, soils support a northern desert shrub type consisting of big and low sagebrush communities. The low sagebrush community occurs in areas of shallow soils over bedrock. It is dominated by low sagebrush, with Thurbers needlegrass and bottlebrush squirreltail dominating the grass understory. In areas of deeper soils, a big-sagebrush community is dominant.

- *Spanish Springs Valley*

The Orr Ditch flows through lower Spanish Springs Valley, providing water for irrigated pasture and crop land. Approximately 1,850 acres of the valley floor consists of agricultural land that includes irrigated pasture and crops (Washoe County, 1991a). Soils on the valley floor support a salt desert shrub vegetation type that consists of a black greasewood dominated community where a seasonally high groundwater table occurs, and a shadscale community in areas not affected by groundwater (SCS, 1983). The black greasewood community consists of black greasewood, saltgrass, rubber rabbitbrush, and basin wildrye. The shadscale vegetation community consists of shadscale, spiny hopsage, and budsage (SCS, 1983); it extends beyond the valley floor to the lower alluvial terraces surrounding the valley.

On upper alluvial fans and terraces on either side of the valley, soils are moderately deep and well-drained and generally non-saline and non-alkaline (SCS, 1983). They support a northern desert shrub type that consists primarily of a big-sagebrush community. Big sagebrush is the dominant shrub, with antelope bitterbrush, desert peach and ephedra occurring as sub-dominant shrubs (SCS, 1983). Grasses include Thurbers needlegrass, bottlebrush squirreltail and Indian ricegrass. The higher slopes of the ranges to either side support a sagebrush and scattered juniper community.

Several areas of riparian and wetland vegetation exist within the lower, southern portion of Spanish Springs Valley. The riparian areas occur along the Orr Ditch and along associated irrigation ditches. The wetland habitats occur in areas supported by seepage from ditches and in association with irrigated areas where the groundwater table is at or very near the surface. Approximately 1,300 acres of wetland and riparian vegetation occur in southern Spanish Springs Valley (Washoe County, 1991a). Plant species in the wetlands/riparian areas include cottonwood, willow, cattails and a variety of perennial grasses and forbs that require moist soils.

- *Truckee Meadows Area*

Within the Truckee Meadows, the major types of natural vegetation consist of wet meadows, salt desert shrub and northern desert shrub communities, riparian zones, and wetlands. Along the Truckee River and along major creeks and irrigation ditches in the area, a riparian and wetlands corridor exists. Riparian species in these areas typically include Fremont cottonwood, black cottonwood, alder, willow, wildrose, chokecherry and a variety of forbs and wet meadow grasses. Wetlands and wet meadows also exist in the vicinity of lakes and ponds in association with irrigated pastures in the southern Truckee Meadows.

Wetland species that occur in areas inundated for a majority of the growing season consist of cattails, bulrush, spikerush and pondweed. Wet meadow species include sedges, Baltic rush and a variety of native and introduced pasture grasses.

Undeveloped land on the perimeter of the metropolitan area and the suburbs support native shrub communities that consist of either a salt desert shrub or northern desert shrub vegetation type. The salt desert shrub type generally occurs in areas below 4,500 feet in the north valleys and on the eastern edge of the Truckee Meadows area. Species that commonly occur in the salt desert shrub type include black greasewood and saltgrass in areas affected by a seasonally high water table and a shadscale community elsewhere that consists of shadscale, fourwing saltbush, rabbitbrush and Bailey's greasewood. The northern desert shrub vegetation type consists of several types of big and low sagebrush communities. The foothills of the Sierra Nevada and Peavine Mountain on the western edge of the Truckee Meadows support sagebrush/mixed shrub/juniper communities that consist of sagebrush, antelope bitterbrush, ephedra, desert peach, scattered Utah juniper, and many other species. The higher parts of the Mount Rose fan support a transitional zone between the sagebrush/mixed shrub/juniper communities and the Jeffrey pine forest at higher elevations.

Areas recently burned by wildfires support a cover of plants such as cheatgrass, tansy mustard, and Russian thistle.

3.6.4 *Threatened, Endangered, and Rare Plants*

Federally-listed endangered and threatened plant species are designated by the U.S. Fish and Wildlife Service (50 Code of Federal Regulations 17.12). California-listed species are those native plants designated as endangered, threatened or rare by the California Fish and Game Commission pursuant to Section 1904 (Native Plant Protection Act of 1977) and Section 2072.7 (California Endangered Species Act of 1984) of the California Fish and Game Code. Nevada also lists plant species that are endangered and threatened (Nevada Administrative Code 527.010).

No plant species that are on any of the above-referenced federal or state lists, nor habitat for such species, are known to occur within the proposed pipeline rights-of-way, the water source area, or the delivery area. This conclusion is based on searches of computerized databases on occurrences of threatened and endangered plants for both California and Nevada (CDF&G, 1992; Nevada Natural Heritage Program, 1992) and on a search of the literature regarding habitat requirements and localities of the listed species.

The U.S. Fish and Wildlife Service (FWS) maintains a list of plant taxa that are currently being reviewed for possible future listing as endangered or threatened (FWS, 1990). It is BLM policy to fully consider candidate species and their habitats as well as listed species. One candidate plant species designated Category 2, *Nevada oryctes*, occurs in the general region of the pipeline rights-of-way. Candidate 2 species are those plant taxa for which there is some evidence of vulnerability, but for which there are insufficient data at present to support a proposal for listing (FWS, 1990). *Nevada oryctes* occurs within deep, loose

sands in several parts of Nevada (Mozingo and Williams, 1980). It is known to occur within the floodplain of the Truckee River near Wadsworth, about two miles east of the end of the proposed gas pipeline (Nevada Natural Heritage Program, 1992). However, the pipeline right-of-way in this area does not appear to contain appropriate habitat for this species, and it was not recorded during field surveys (JBR, 1990c).

No candidate plant species have been recorded in the delivery area in Lemmon and Spanish Springs Valleys. Altered andesite buckwheat, *Eriogonum lobbii* var. *robustum*, a Category 2 candidate species, occurs near Panther Valley, south of the delivery area (Nevada Natural Heritage Program, 1992). The known range of this species is restricted to hydrothermally altered andesite soils in Washoe and Storey Counties (Mozingo and Williams, 1980). These characteristic soils do not occur within Lemmon and Spanish Springs Valleys or along the pipeline rights-of-way. Therefore, the species is not expected to occur there.

No endangered plant species occur within the greater Truckee Meadows. The only known candidate plant species in the area is the altered andesite buckwheat, discussed above. It occurs on the slopes of Peavine Mountain and in the Sun Valley and Panther Valley areas north of Reno. The Steamboat buckwheat, an endangered plant species, is restricted to the deposits formed by the hot springs at Steamboat Hot Springs south of the Truckee Meadows.

3.7 WILDLIFE RESOURCES

Information on wildlife and their habitats was compiled from several published studies on the area (Fowler et. al, 1982; CDF&G, 1989; BLM, 1988; NDOW, 1991); from coordination with BLM resource personnel, the U.S. Fish and Wildlife Service (FWS), the Nevada Department of Wildlife (NDOW), the California Department of Fish and Game (CDF&G), and individual researchers; from field studies by JBR (1990a, 1990b, 1990c, 1990d); and from field visits by the EIS staff. Appendix E lists wildlife species that have been observed along the proposed and alternative pipeline routes and in the water source area.

3.7.1 Pipeline Routes

The proposed and alternative pipeline routes include big and low sagebrush habitats in the upper elevations and salt desert shrub in the lower valleys. These vegetation communities provide habitat for a variety of rodents, small and medium-sized mammals and songbirds that are common and abundant throughout these habitats in western Nevada and eastern California. Small- and medium-sized mammal species that are commonly associated with these habitats include antelope ground squirrels, pocket mice, deer mice, kangaroo rats, black-tailed jackrabbits, foxes, and coyotes. Rodent and rabbit populations are generally higher in sagebrush habitats than in salt desert shrub habitats, reflecting the higher percent cover and diversity of vegetation. Fautin (1946) recorded mouse populations of about 120 per acre in big sagebrush and greasewood communities compared with 100 per acre in shadscale and low sagebrush communities, suggesting some correlation with vegetation cover and shrub height, both of which were greater in the big sagebrush and greasewood habitats.

In the same study, black-tailed jackrabbits were also found to be more numerous in big sagebrush and greasewood communities than in more open shadscale communities.

Both sagebrush and salt desert shrub communities also support between five and 10 species of breeding songbirds (Smith et al., 1984; Wiens and Rotenberry, 1981; Medin, 1986; 1990). Shrubland birds select habitat based on the height of shrubs (Wiens and Rotenberry, 1981). Therefore, vegetation communities with similar shrub heights will have similar songbird populations, regardless of the species of dominant shrub. In the affected area, shadscale communities are generally low and widely spaced; they support bird species that prefer relatively open areas such as horned larks, meadow larks, and black-throated, savannah and lark sparrows. Bird species that occur in sagebrush and greasewood habitats in the affected area include Brewers, white-crowned, and sage sparrows and sage thrashers. Researchers have recorded bird densities in shadscale habitats of about three birds per acre and in sagebrush habitats between five and nine birds per acre (Fautin, 1946; Smith et al., 1984; Medin, 1986).

Riparian habitat, wet meadows, and wetlands are valuable wildlife habitat because of the availability of water and dense vegetation cover. While riparian and wetlands habitats cover a small percentage of the area along the pipeline routes, they provide seasonal or year-long habitat for up to 80 percent of all vertebrate species recorded in the area (BLM, 1988). Bird density and diversity are particularly high in riparian habitats. Species represented in the affected area include several species of warblers, flycatchers, wrens, swallows, doves, and quail. Riparian habitat occurs on private land along stretches of Cottonwood Creek and its tributaries in the vicinity of the gas pipeline route. Limited areas of wet meadow habitat occur within several small drainages along both the proposed and alternative pipeline routes. Substantial areas of wet meadow habitat occur in association with springs and seeps along the Red Rock Valley alternative route segment.

The following sections discuss game species and other species of concern along the pipeline routes.

- *Mule Deer*

The most economically important big game species in the region is mule deer (Figure 3.7-1). The proposed and alternative pipeline routes are located within NDOW's Deer Management Area 2, in Management Units 021 and 020. The Management Area supports resident deer herds and provides significant winter range for the Lassen-Washoe Interstate deer herd. This deer herd migrates into Nevada from their summer ranges in the Sierra Nevada and the Modoc Plateau and utilizes wintering habitat in eastern California and western Nevada.

The Lassen-Washoe Interstate deer herd is composed of two main herds; the Doyle herd, which summers in California north of Petersen Mountain and winters in Honey Lake Valley and western Nevada, and the Loyalton-Truckee herd, which summers in California south of Petersen Mountain and winters in western Nevada (Fowler et al., 1982). Recent population estimates for the interstate deer herd are 20,000 animals equally divided between the Doyle and Loyalton-Truckee herds (BLM, 1988).

Figure 3.7-1 depicts mule deer summer and winter ranges in the region crossed by the proposed and alternative pipeline routes and major migration routes between summer and winter ranges. Resident mule deer populations exist on Petersen Mountain, Seven Lakes Mountain, Fort Sage Mountains, Dogskin Mountain, Virginia Mountains, and the Pah Rah Range. Wintering habitat for the Lassen-Washoe Interstate deer herd is also available in the Petersen Mountain-Seven Lakes Mountain-Sand Hills area, the Fort Sage Mountains, the Dogskin Mountains, and the western foothills of the Virginia Mountains. These areas are crucial mule deer range (BLM, 1988). Petersen Mountain and adjacent areas are also NDOW-designated critical winter range. The Fort Sage, Dogskin, and Virginia Mountains, and the Pah Rah Range are important for both winter and summer range.

Wintering habitat in the vicinity of the proposed and alternative pipeline routes is extremely important to both resident and migrating deer herds. The major threat to mule deer populations in the region is loss of sagebrush-bitterbrush wintering habitat to wildfires and to suburban development because these are the two most important browse plants to wintering mule deer (BLM, 1988). Bitterbrush is the key browse species in fall and early winter, succeeded by sagebrush in late winter (Fowler et al., 1982). Together, these two plant species constitute between 65 and 75 percent of the diet of mule deer between September and March (Leach, 1956).

Wildfires in the region have seriously affected bitterbrush-sagebrush communities. More than 75 percent of the winter range in the Petersen Mountain-Sand Hills-Seven Lakes Mountain area has been degraded by fire over the last 20 years (BLM, 1988). Attempts to re-establishment bitterbrush in these areas by seeding have had little success (BLM, 1988). Segments of the pipeline routes that support bitterbrush/sagebrush vegetation types are depicted on Figure 3.6-1 and discussed in Section 3.6.

- *Pronghorn Antelope*

Figure 3.7-2 depicts pronghorn antelope use-areas that have been identified by the BLM and NDOW. Pronghorn generally range throughout the region crossed by the proposed and alternative pipeline routes. Between 100 and 150 pronghorn use the western flanks of the Pah Rah Range and between 75 and 100 pronghorn use Bedell Flat, Winnemucca Valley, and Dry Valley Creek (Figure 3.7-2).

The pronghorn's diet in fall and winter is composed almost exclusively of browse, with various species of sagebrush comprising the dominant food (Sundstrom et al., 1973; Beale and Smith, 1970). Pronghorn disperse widely throughout the region in spring and summer in search of succulent forbs and grasses, which comprise a large component of their diet in these seasons (Tsukamoto, 1983; Sundstrom et al., 1973). The limiting factor that keeps pronghorn populations relatively low in the region is the lack of succulent forbs and grasses in the spring and early summer (BLM, 1988).

- *Upland Game Birds*

Upland game birds that occur along the pipeline routes include sagegrouse, quail, chukar and mourning doves.

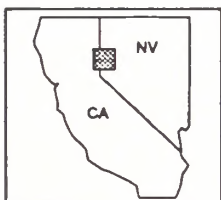
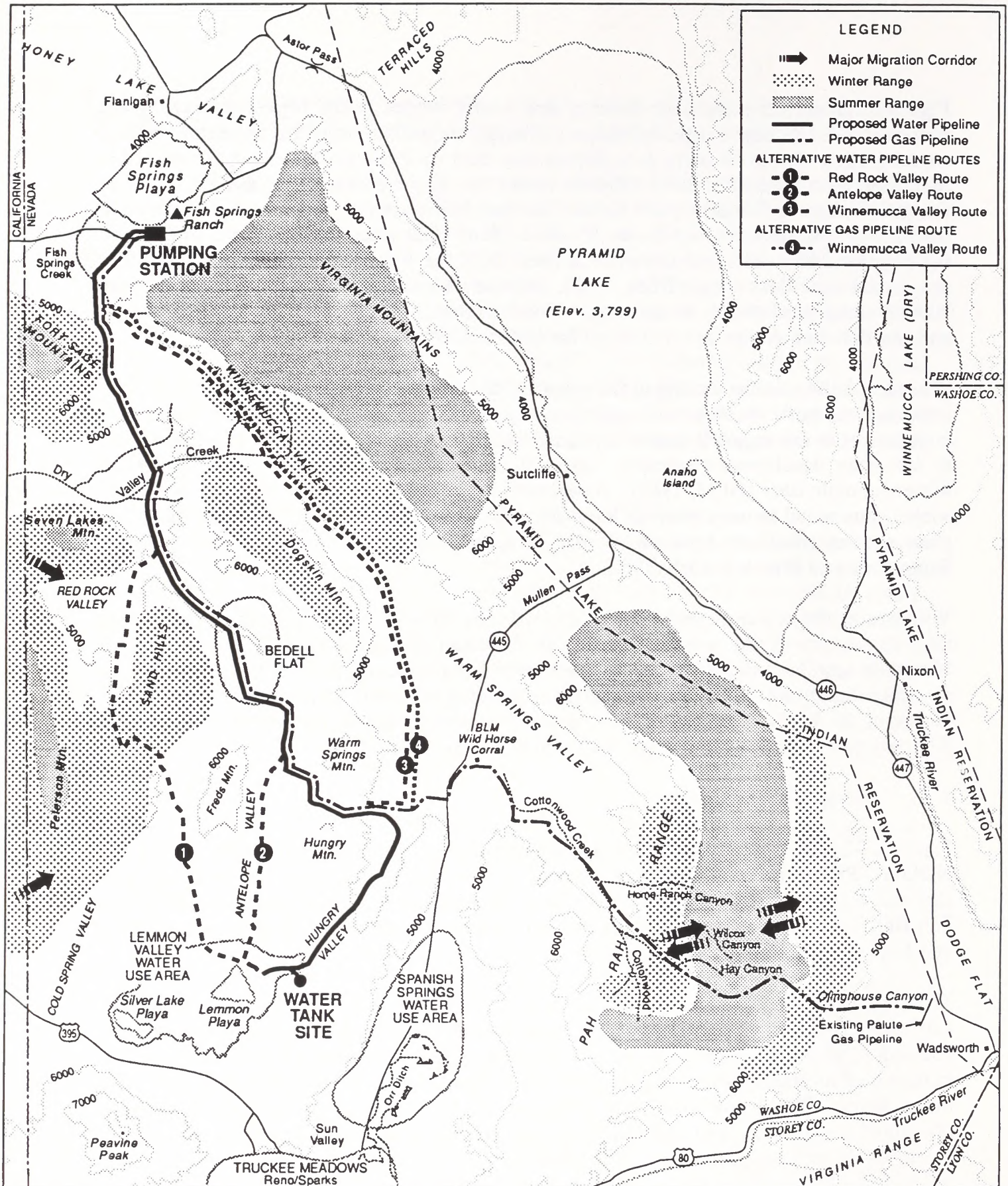
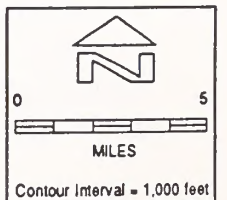
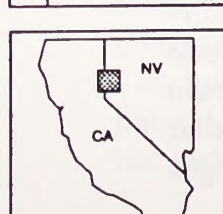


Figure 3.7-1

Mule Deer Summer and Winter Ranges In Project Area





Pronghorn Antelope, Sage Grouse and Mountain Quail Habitat in Project Area

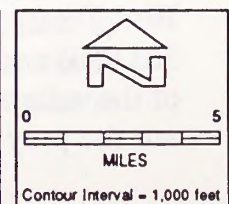


Figure 3.7-2 shows the location of sagegrouse habitat in the area, along with the location of known leks (breeding grounds). Sagegrouse populations in the area are very low (BLM, 1988). The major limiting factor is the lack of good mountain meadow habitat for chick rearing (BLM, 1988; BLM, 1982b). The Virginia Mountains support a small population of sagegrouse; no leks have been identified, but several undoubtedly exist (BLM, 1982b). The two leks shown on Figure 3.7-2 associated with the Sand Hills sagegrouse populations have not been used in recent years (BLM, 1988; Brigham, 1992). One of the currently unused leks at Bedell Flat is less than one-half mile from the proposed water and gas pipelines route. Sagegrouse are still regularly sighted in the Sand Hills, so it is likely that other leks and brood-rearing habitat exist there (Dobel, 1992). The Pah Rah Range has the best sagegrouse habitat along the pipeline routes. Several small meadows that are suitable for brood rearing are located in the higher elevations of the Pah Rah Range. No leks have been identified in this area, but they undoubtedly exist because young birds have been sighted in this area (Dobel, 1992). Sagegrouse were observed near creeks and in uplands of the Pah Rah Range during summer studies in 1990 (JBR, 1990c).

Two species of quail, both hunted as game, occur in the region. California quail occur wherever appropriate water and vegetation cover are found. They are common around ranches and residential developments throughout western Nevada and along riparian areas in the mountains and foothills. The mountain quail has recently been designated by the FWS as a candidate for potential future listing as either threatened or endangered and is discussed in greater detail in Section 3.7.4.

Chukar habitat is so widespread and abundant throughout the region that it is not depicted on Figure 3.7-2. Petersen Mountain, the north end of Dogskin Mountain, the Pah Rah Range, and the Virginia Mountains contain the best chukar habitat in the region (BLM, 1988; BLM, 1977; 1982b). Chukar densities in these areas range from moderate (16-29 birds per square mile) to high (30 to 50 birds per square mile) (BLM, 1982b). Hungry Valley, Hungry Mountain, and Warm Springs Valley lack water and steep rocky slopes, and are thus marginal chukar habitat (BLM, 1982b). Chukar require a source of water during the summer (Ryser, 1985), and water availability is the limiting factor for good chukar habitat (BLM, 1988). Several guzzlers have been developed on Petersen Mountain and in the Pah Rah Range to improve habitat (BLM, 1982; BLM, 1977). None of the pipeline routes are near any of these guzzlers.

Mourning doves are common and widespread throughout the region, occurring in a variety of shrub and upper-elevation woodlands. Although doves require a source of drinking water, they often nest miles away from water (Ryser, 1985).

• *Raptors*

Raptors include hawks, eagles and owls. They are protected under the Federal Migratory Bird Treaty Act and are also a protected species in Nevada (Nevada Administrative Code 503.050) and are considered by the BLM to be species of special concern. The open terrain of the valleys and foothills supports large populations of rodents, rabbits and small birds that are the prey base for many species of raptor. Most species utilize large trees or cliff ledges

for nesting. Several active raptor nests were found in the vicinity of the proposed and alternative routes during field studies. Nesting species observed near the route of the water pipeline included red-tailed hawk, Swainson's hawk, American kestrel, and great horned owl. Raptor-nesting habitat in junipers is also available along parts of the proposed gas pipeline route. Swainson's hawks and short-eared owls were observed along the gas route, but nesting was not documented (JBR, 1990c). Other raptors observed during field studies are listed in Appendix E.

- *Waterfowl and Shorebirds*

Few perennial waters of any size exist near the proposed and alternative pipeline routes. Several playas and seasonally-flooded areas provide resting places for migrating waterfowl and shorebirds. No seasonally-flooded areas are crossed by the pipeline routes.

- *Fish Habitat*

Perennial water is limited in the immediate vicinity of the pipeline routes. Perennial stream flow occurs on private land along parts of Hay, Wilcox, and Cottonwood Creeks in the vicinity of the proposed gas pipeline route. These areas support small populations of native fish such as speckled dace. However, there are no water bodies in the vicinity of the pipeline routes that support a recreational fishery.

3.7.2 *Water Source Area*

Honey Lake and its associated wetlands are located in western Honey Lake Valley. These wetlands are the most important wildlife habitat in Honey Lake Valley. Honey Lake is the terminus for several streams that drain the Modoc Plateau, and the Diamond and Fort Sage Mountains. The lake fluctuates greatly in volume and area on a seasonal and annual basis. The most important wetlands are north of Honey Lake along the Susan River and its canals and sloughs. These include Honey Lake Wildlife Area and Honey Lake Waterfowl Management Area, both of which are under the jurisdiction of the State of California. These wetlands are an important stopover on the Pacific Flyway for migrating shorebirds and waterfowl. Two-hundred and nine species of birds have been confirmed in the Honey Lake Wildlife Area, 55 of which are known to breed there (CDF&G, 1992). Two federally listed endangered species winter at the Honey Lake wetlands and several California-listed and federally designated candidate species use the wetlands for migration, and wintering and breeding habitat (Section 3.7.4). Additional smaller areas of wetlands occur around the lake on land under the jurisdiction of the Sierra Army Depot and on privately maintained waterfowl and hunting clubs.

The primary focus for potential impacts from groundwater withdrawal in the water source area is eastern Honey Lake Valley and the southwestern Smoke Creek Desert. Vegetation consists of various types of greasewood, shadscale and sagebrush shrub communities. Common wildlife within these shrub habitats is discussed in Section 3.7.1. The shrub habitats in eastern Honey Lake Valley support limited wildlife populations, due in part to the lack of surface water.

The only riparian habitat in eastern Honey Lake Valley is along Spencer and Skedaddle Creeks in the Skedaddle Mountains. Four low-flowing wells located near the Herlong Siding support a few cottonwood and Russian olive trees and a small stand of apple trees. The only other stands of trees and tall shrubs on the floor of eastern Honey Lake Valley are associated with water developments around ranches and home sites. The available water and cover at these areas provide habitat for several wildlife species that do not occur in the surrounding desert shrub habitats. Wildlife species identified in such habitat include northern orioles, wrens, flycatchers, warblers, California quail and doves.

Wet meadows and open water habitats occur in some years in seasonally flooded areas in the vicinity of Duck and Calneva Lakes in eastern Honey Lake Valley. Irrigation flows at High Rock Ranch and Fish Springs Ranch also support limited areas of wet meadows and wetlands. Several areas of wetlands occur in the Smoke Creek Desert, including Bonham Ranch, Buckbrush Spring, and Laird Spring. The wetlands are supported by both springs and naturally flowing wells. The largest, about 180 acres, occurs at Bonham Ranch. Cottonwood and Russian olive trees around the old ranch site enhance the wetlands habitat.

The following sections discuss game species and other species of concern in the water source area.

- *Mule Deer*

The Nevada side of the water source area is within the NDOW's Deer Management Unit 015 in Management Area 1, and Management Unit 021 of Management Area 2 (NDOW, 1991). The California side of the water source area is within CDF&G Deer Hunting Zone X-6 (CDF&G, 1990). An additional antlerless hunt area, S-26, is designated around the Doyle State Wildlife Range (CDF&G, 1990). The southern portion of Honey Lake Valley is within the winter range of the Doyle Interstate deer herd. The Doyle State Wildlife Area, covering 13,500 acres in southern Honey Lake Valley and Long Valley, was established to preserve crucial winter range for the Doyle herd.

The most important mule deer habitat in the area is the sagebrush-antelope bitterbrush vegetation community identified on Figure 3.6-2. This vegetation community occurs in southern Honey Lake Valley and on the alluvial flanks and foothills of the Fort Sage Mountains. Antelope bitterbrush is a major component of mule deer diet in early winter (Fowler et al., 1982). Sagebrush also provides important deer winter browse and constitutes the primary browse species for deer in late winter (Fowler et al., 1982).

- *Pronghorn Antelope*

The water source area is within NDOW's Big Game Management Unit 015 and CDF&G Pronghorn Management Zone 4 (NDOW, 1991; CDF&G, 1991a). Pronghorn antelope occur throughout Honey Lake Valley in all seasons. They prefer large open expanses with shrub height less than 15 inches (Tsukamoto, 1983; Sundstrom et al., 1973). The low sagebrush communities around the valley perimeter constitute the primary habitat for pronghorn in the area, but the animals also use the salt desert shrub habitats on the valley floor. Pronghorn are attracted to irrigated alfalfa and hay crops at ranches within the valley

and to spring and early summer growth of forbs and sedges that occurs on seasonally-flooded playas in the valley (Tsukamoto, 1983; CDF&G, 1991a).

- *Upland Game Birds*

California quail and mourning doves occur near ranches and water developments in Honey Lake Valley and near Bonham Ranch in the Smoke Creek Desert. Mountain quail do not occur on the valley floors. Eastern Honey Lake Valley and the Smoke Creek Desert have no habitat for sagegrouse or chukar.

- *Raptors*

The flat shrublands of eastern Honey Lake Valley and the Smoke Creek Desert offer few nesting sites for raptors. Power poles and trees around ranches and a few isolated trees associated with flowing wells in the vicinity of Herlong Siding in eastern Honey Lake Valley provide nesting sites for some species of raptors such as red-tailed hawks, kestrels and great horned owls. A pair of golden eagles regularly nest in a cottonwood tree near High Rock Ranch. Honey Lake Valley is used as hunting territory by several species of raptors that nest in the mountains north and south of the valley. Alfalfa and hay fields in Honey Lake Valley, with their high concentrations of rodents and rabbits, support the largest numbers of hunting raptors. Several species of hawks also winter here, including ferruginous hawks, rough-legged hawks and red-tailed hawks. Appendix E lists the raptor species that have been sighted in the valley during field surveys.

- *Waterfowl and Shorebirds*

The wetlands associated with Honey Lake, described earlier, attract large numbers of many species of migrating shorebirds and waterfowl (Kjelmyr et al., 1991). Several species of shorebirds and some waterfowl also use seasonally flooded areas at various playa lakes in eastern Honey Lake Valley. In most years, these lakes are dry by summer. In exceptionally wet years, the playa lakes may persist through the summer and provide some nesting habitat for waterfowl and shorebirds. Following the wet winter of 1986, the large playa near Fish Springs Ranch filled with water and was used that summer by thousands of Canada geese, which fed in the nearby alfalfa fields of the ranch (JBR, 1990c).

At Duck Lake along the western edge of the water source area, there are several seasonally flooded areas that attract shorebirds and waterfowl, including the greater sandhill crane, a California listed threatened species, and the snowy plover, a federal candidate species (Section 3.7.4). Duck Lake has been dry during the past several years of drought. The small area of wetlands at High Rock Ranch associated with irrigation also attract some shorebirds and waterfowl.

The wetlands at Bonham Ranch in the Smoke Creek Desert attract several species of shorebirds and waterfowl including American bittern, black neck stilt, snipe, sora rail, avocet, American coot, killdeer, spotted sandpiper, mallard and cinnamon teal (JBR, 1990b).

- *Fish Habitat*

Within eastern Honey Lake Valley, only High Rock Spring is known to support fish populations. During the 1980s several individuals of an exotic species of tilapia were placed in High Rock Spring under permit from the CDF&G (Chappell, 1992). Tilapia have apparently eradicated any native fish that may have previously inhabited the High Rock Spring system, including the High Rock tui chub that has recently been designated by the FWS as a candidate species (Section 3.7.4).

Fish Springs originally supported native fish, including a population of the tui chub (Chappell, 1992). The spring dried up in the 1980s as groundwater withdrawals for irrigation increased at Fish Springs Ranch; fish populations that inhabited the springs were lost.

Perennial water at Bonham Ranch supports fish populations. Recent field investigations at the ranch collected mosquitofish and catfish, both introduced species (JBR, 1990c). No native species were found.

No fisheries exist in the water source area.

3.7.3 *Delivery/Use Area*

- *Lemmon Valley*

Undeveloped portions of Lemmon Valley support salt desert shrub and sagebrush vegetation. Wildlife species in such habitats are described in Section 3.7.1. The developed portions of Lemmon Valley support denser concentrations of housing than in Spanish Springs Valley. Thus, very little wildlife exists in the developed areas. Limited areas of wet meadows and wetland habitat exist around the playa in Lemmon Valley. In wet years, Lemmon playa supports waterfowl and shorebirds. Bald and Golden eagles have been reported in the area. Song birds and marshhawks may nest in the wetlands.

Lemmon Valley is not within any identified critical winter range or important yearlong range for mule deer. It is not within an identified pronghorn use area.

- *Spanish Springs Valley*

Vegetation in the undeveloped portions of Spanish Springs Valley consists of black greasewood and shadscale communities on the valley floor, and big sagebrush communities on the alluvial fans and foothills of the surrounding mountains (Section 3.6.3). These areas provide habitat for a variety of small mammals and songbirds (Section 3.7.1).

Much of the existing residential areas in Spanish Springs Valley consist of relatively low density housing--one dwelling per one to five acres. A variety of wildlife tolerant of human presence occurs in these areas, attracted by the water and planted trees and shrubs, including jackrabbits, ground squirrels, mourning dove and California quail.

Riparian habitat occurs along the Orr Ditch and smaller irrigation ditches in southern Spanish Springs Valley. Wetlands also occur in southern Spanish Springs Valley, supported by seepage from irrigation ditches, irrigation return flows from pastures and alfalfa, and near-surface groundwater from irrigation. About 1,300 acres of wetland and riparian vegetation occurs in southern Spanish Springs Valley (Washoe County, 1991a). These habitats support a variety of shorebirds, waterfowl, songbirds, and small- and medium-size mammals.

Spanish Springs Valley is not within any identified critical winter range or important year-long range for mule deer. It is not within an identified pronghorn use area.

- *Truckee Meadows Area*

The riparian corridor along the Truckee River and the river itself represent some of the most valuable wildlife habitat within and outside of the developed portion of the Truckee Meadows. The river supports about 28 species of fish, 12 of which are game species. Mammalian species that occur along the river and riparian corridor include beaver, muskrat, weasels, skunks, shrews, bats, a variety of rodents, cottontail, coyote and deer. Several species of shorebirds and waterfowl use the river and wetland areas and a large number of songbirds, hawks, and owls use the riparian habitat. Wetland and riparian habitats also occur along irrigation ditches, creeks, and in association with lakes throughout the metropolitan area and surrounding undeveloped areas. Several irrigated pastures and fields in the southwest Truckee Meadows also provide valuable habitat for a variety of small mammals and birds.

Undeveloped land surrounding the greater Truckee Meadows area consists of salt desert shrub and sagebrush habitats. Wildlife species that occur in these areas are typical of those that occur in shrublands throughout western Nevada. The foothills on the western and southwestern edge of the Truckee Meadows and on the lower slopes of Peavine Mountain support a sagebrush-juniper habitat that provides valuable winter range for a portion of the Loyalton-Truckee mule deer herd (part of the Lassen-Washoe Interstate herd).

3.7.4 Endangered, Threatened, and Candidate Animal Species

This section discusses endangered, threatened, and candidate animal species that may occur within the affected area (includes the pipeline routes, the water source area, and the delivery area). Table 3.7-1 lists the animal species of concern whose range and habitat preferences include the affected area. Species included in Table 3.7-1 were identified by consultation with FWS, NDOW and CDF&G; by searches of the California and Nevada computer databases for sensitive species (CDF&G, Natural Diversity Database, 1992; Nevada Natural Heritage Program, 1992); and by review of the literature.

TABLE 3.7-1
ENDANGERED, THREATENED AND CANDIDATE ANIMAL SPECIES
WHOSE RANGE INCLUDES THE AFFECTED AREA

Species	Status ^(b)
Birds:	
^(a) Bald eagle, <i>Haliaeetus leucocephalus</i>	Fed. E, Calif. E, Nev. E
Peregrine falcon, <i>Falco peregrinus</i>	Fed. E, Calif. E, Nev. E
Ferruginous hawk, <i>Buteo regalis</i>	Fed. C-2, Nev. P
Northern goshawk, <i>Accipiter gentillis</i>	Fed. C-2, Nev. P
Western snowy plover, <i>Charadrius alexandrinus nivosus</i>	Fed. C-2
Black tern, <i>Chlidonias niger</i>	Fed. C-2
Mountain quail, <i>Oreortyx pictus</i>	Fed. C-2
White-faced ibis, <i>Plegadis chihi</i>	Fed. C-2, Nev. P
Western least bittern, <i>Ixobrychus exilis hesperis</i>	Fed. C-2
Loggerhead shrike, <i>Lanius ludovicianus</i>	Fed. C-2
Swainson's hawk, <i>Buteo swainsoni</i>	Fed. C-3C, Calif. T, Nev. P
Bank swallow, <i>Riparia riparia</i>	Calif. T
Greater sandhill crane, <i>Grus canadensis tabida</i>	Calif. T
Mammals:	
^(a) Pygmy rabbit, <i>Brachylagus idahoensis</i>	Fed. C-2
^(a) Spotted bat, <i>Euderma maculatum</i>	Fed. C-2, Nev. Rare
^(a) Pacific fisher, <i>Martes pennanti pacifica</i>	Fed. C-2
Fish:	
^(a) Cui-ui, <i>Chasmistes cujus</i>	Fed. E
^(a) Lahontan cutthroat trout, <i>Oncorhynchus clarki henshawi</i>	Fed. T
^(a) High Rock Spring tui chub, <i>Gila bicolor spp.</i>	Fed. C-1
^(a) Species potentially occurring in the affected area as identified by the U.S. Fish and Wildlife Service (FWS List File No. 1-5-92-SP-65). ^(b) Fed. T and Fed. E refer to those species presently listed by the FWS as threatened (T) and Endangered (E) (50 CFR 7.11). - Fed. C-1 species are candidate species for which the FWS presently has sufficient information to support a proposal for listing as endangered or threatened, but for which a formal proposal for listing has not yet been promulgate. - Fed. C-2 species are those candidate species that the FWS considers may be appropriate for future proposal to list as threatened or endangered, but for which conclusive data on biological vulnerability and threat are not currently available to support either a proposal for listing or removal from consideration. The FWS states that there are no specific plans for proposal for listing of Category 2 taxa unless additional information becomes available to support the proposed listing (FWS, 1991) - The Sagebrush/Bitterbrush Component refers to the several big and low sagebrush vegetation types that have antelope bitterbrush as a significant sub-dominant shrub species. - Calif. T and Calif. E refer to those species presently listed by the California Fish and Game Commission as Threatened (T) and Endangered (E) (CDF&G, 1991b). - Nev. Rare refers to those species classified as Rare per Nevada Administrative Code (NAC) 503.030. - Nev. P refers to birds that are classified as Protected Birds per NAC 503.050 (2&3). - Nev. E refers to those species that are classified as endangered per NAC 503.050 Sect. 4 (bird species) and NAC 503.065 Sect. 2 (fish species).	

- *Bald Eagle*

Bald eagles are common winter visitors to the wetlands around Honey Lake, attracted by the large concentration of wintering waterfowl, which provide a prey base. Wintering bald eagles have also been observed in Long Valley, south of Honey Lake (BLM, 1988). Eastern Honey Lake Valley provides little food or roosting habitat for eagles. In the vicinity of the pipeline routes, wintering bald eagles have been observed in Red Rock Valley, in Dry Valley, and west of the Fort Sage Mountains (BLM, 1988).

- *Peregrine Falcon*

Peregrine falcons are not known to nest in the affected area. They are occasional winter visitors to the wetlands around Honey Lake; they have not been recorded from eastern Honey Lake Valley or the Smoke Creek Desert. Waterfowl are their preferred prey (Herron et al., 1985). The water source area, the pipeline routes, and the delivery area offer little habitat for wintering peregrines.

- *Ferruginous Hawk*

The ferruginous hawk is an occasional winter visitor to Honey Lake Valley, but has not been recorded as a nesting species (CDF&G, 1992). The ferruginous hawk rarely nests in western Nevada (Ryser, 1985). The species prefers nest sites in junipers overlooking broad valleys (Herron et al., 1985). The water source area and pipeline routes provide limited potential nesting habitat for the species.

- *Northern Goshawk*

The northern goshawk is widely distributed throughout Nevada and nests in mountain forests in many most of Nevada's mountain ranges (Ryser, 1985). Preferred nesting sites are aspen swales near perennial streams. More than 98 percent of the observed nest sites in Nevada were within 100 feet of water (Herron et al., 1985). Within the affected area, goshawk habitat may occur in the Virginia and Pah Rah Mountains.

- *Western Snowy Plover*

The interior populations of the western snowy plover breed at several shallow, alkaline lakes and seasonally flooded playas throughout the west (Page and Stenzel, 1981; Page et al., 1991). During a 1978 breeding survey, 208 birds were observed around Honey Lake which accounted for 11 percent of the interior population of the plovers counted in California that year (Page and Stenzel, 1981). The birds were concentrated along the southeast and north shores of Honey Lake; breeding birds were only confirmed on the north shore of the lake (Page and Stenzel, 1981). In 1988, 150 birds were counted at Honey Lake (Page et al., 1991). There is general consensus that the species responds to fluctuations in availability of nesting habitat due to changing water conditions by shifting the location of breeding areas from year to year (Herman et al., 1988; Page et al., 1991).

Within the water source area, seasonally flooded playas represent nesting habitat for snowy plovers when surface runoff is sufficient to maintain some open water through the nesting season. In favorable years, plovers have been recorded at Duck and Calneva Lakes in eastern Honey Lake Valley. Possible habitat for plovers may occur in the southwestern Smoke Creek Desert, but these areas have not been surveyed for plovers (Herman et al., 1988). No potential plover nesting habitat is in the vicinity of the pipeline routes or in the delivery area. Lemmon playa probably does not represent nesting habitat for the snowy plover because of its proximity to urban development.

- *Black Tern*

The black tern requires dense emergent vegetation in freshwater marshes and wetlands for nesting (Ehrlich et al., 1988). In Honey Lake Valley, the black tern nests only within the wetlands north of Honey Lake. Habitat for the terns may occur at the wetlands at Bonham Ranch in the Smoke Creek Desert, but nesting black terns have not been confirmed. No habitat for the terns occurs in the vicinity of the pipeline routes. Habitat for black terns may occur within the wetlands in Spanish Springs Valley, but no nesting terns have been confirmed (Section 3.4.3).

- *Mountain Quail*

Mountain quail were recently designated as a candidate species by the FWS. The quail is also a game species designated by California and Nevada. Mountain quail habitat in the region traversed by the pipeline routes is shown on Figure 3.7-2. Mountain quail frequent areas of dense shrub vegetation at high elevations, generally within one mile of water (Ryser, 1985; Brennan et al., 1987). No mountain quail habitat exists in Honey Lake Valley, the southern Smoke Creek Desert, the delivery area, or in the greater Truckee Meadows.

- *White-Faced Ibis*

The white-faced ibis commonly nests in large wetlands throughout the Great Basin. It nests in small to large colonies in tule marshes. Nests are constructed on open water or on islands within the marsh (Ryser, 1985; Burger and Miller, 1977). White-faced ibis nest at the wetlands north of Honey Lake, but nowhere else in Honey Lake Valley. The wetlands at Bonham Ranch and in Spanish Springs Valley are not of sufficient size to support an ibis colony. No ibis nesting habitat occurs in the vicinity of the pipeline routes or the delivery area.

- *Western Least Bittern*

The least bittern is a rare migrant and breeding species in the Great Basin (Ryser, 1985). This species prefers to nest over water in the remotest parts of marshes, generally in a dense growth of cattails and bulrushes (Ryser, 1985). There are no breeding records for the species in western Nevada in this century (Ryser 1985). The least bittern is not listed as a nesting species on the list of birds confirmed at Honey Lake Wildlife Area (CDF&G, 1992). The species probably does not occur in the affected area.

- *Loggerhead shrike*

The loggerhead shrike is a wide ranging species throughout the continental United States (Miller, 1931; Bent, 1950). The western shrublands probably represent the shrike's original habitat in the United States; clearing for agriculture allowed the shrike to expand eastward (Fraser and Luukkonen, 1986). The species is still relatively abundant in suitable habitats in the western shrublands, but populations are declining in the eastern and central states (Hands et al., 1989; Morrison, 1981). The shrike's habitat requirements are relatively broad; they hunt over open desert country and nest in trees and tall shrubs. Wiens and Rotenberry (1981) found that shrikes were locally abundant in several sagebrush and shadscale plots in Idaho and Nevada. Their occurrence was positively correlated with shrub height, cover, density, and diversity. Medin (1986) and Raitt and Maze (1968) found that shrikes select shrub habitats with the tallest and densest shrubs and generally nest only along intermittent streams. Shrikes generally build their nests about three feet above the ground in the middle of the densest shrubs (Fautin, 1946; Medin, 1986). The shrike hunts over open country and uses barbed wire fences and thorny shrubs as sites on which to impale its prey.

Within the affected area, shrikes can occur wherever there are trees and tall shrubs. Trees at ranches and other habitations throughout the affected area support shrikes. Shrikes were recorded during studies along the pipeline routes and in eastern Honey Lake Valley. They also likely occur in suitable habitat throughout the shrublands of the delivery area and the greater Truckee Meadows.

- *Swainson's Hawk*

The Swainson's hawk is no longer considered a candidate for potential future listing as endangered or threatened by the FWS (FWS, 1991). Its status is 3C; more abundant than previously thought and/or not subject to any identifiable threat. The species is listed as threatened by the State of California.

The Swainson's hawk nests in isolated clumps of trees in agricultural valleys, which offer an abundance of large insects that comprise the hawk's preferred food (Ryser, 1985; Herron et al., 1985). It occurs in Honey Lake Valley and may nest in cottonwood trees around ranches and in scattered junipers in the southern part of the valley.

- *Bank Swallow*

The bank swallow is listed as threatened by the State of California, but it has no official federal status. The species nests in steep-sided sand or gravel and in washes. They will also nest in gravel pits and railroad and highway embankments if these features are near suitable feeding sites such as meadows or water (Terres, 1980). Bank swallows are confirmed to nest at Honey Lake Wildlife Area (CDF&G, 1992). They probably also nest in Long Valley.

- *Greater Sandhill Crane*

The greater sandhill crane is listed as threatened within California, but it is not a federally listed or candidate species. Cranes are confirmed to nest at Honey Lake Wildlife Area

(CDF&G, 1992). They are also reported to use the seasonally flooded meadows and wet areas around Duck Lake (JBR, 1990c).

- *Spotted Bat*

The affected area is within the known range of the spotted bat, a Category 2 candidate species (Table 3.7-1). The bat has a relatively large range, extending throughout the western United States, south to Texas, and north into Canada (Watkins, 1977; Zeveloff, 1988). The species has never been known to be abundant within its range (Fenton et al., 1983). The spotted bat is generally considered by most researchers to be cliff roosting, requiring sheer cliffs with vertical cracks and crevices that provide adequate cover (Wai-Ping and Fenton, 1989; Easterla, 1970; FWS, 1983). The bat is reported to forage over open water, generally near large trees (Woodsworth et al., 1981; Leonard and Fenton, 1983; Berna, 1990). Based on these habitat requirements, the spotted bat is not likely to occur in the water source area, along the pipeline routes, or in the delivery area.

- *Pygmy Rabbit*

The pygmy rabbit's range includes most of the Great Basin. The rabbit is dependent upon big sagebrush for both cover and food, and occurs almost exclusively in areas where these shrubs are tall and occur in dense clumps (Green and Flinders, 1980). In Honey Lake Valley, habitat for the pygmy rabbit occurs within the sagebrush-antelope-bitterbrush habitats in the southern part of the valley. Some stretches of the pipeline routes also support dense stands of sagebrush that are suitable for the rabbit.

- *High Rock Tui Chub*

The High Rock subspecies of the tui chub was recently designated a candidate species (FWS, 1991). The species is considered a Category 1 species and could possibly be proposed for future listing as endangered or threatened.

The High Rock subspecies of the tui chub is known to have occurred in High Rock Spring. Within the last 10 years, several individuals of tilapia, an exotic fish species, were placed in High Rock Spring and have apparently eliminated all other fish species that occurred there, including the High Rock tui chub (Chappell, 1992). Tilapia are known to be voracious feeders on other fish and on invertebrates, and it is likely that this species has eliminated the tui chub and most of the invertebrate population of High Rock Spring (Chappell, 1992). Habitat for the tui chub may have also occurred at Fish Springs, but these springs dried up in the 1980s as a result of increased pumping of groundwater for irrigation at Fish Springs Ranch. The High Rock tui chub has not been recorded from anywhere else in Honey Lake Valley. The California Department of Fish and Game plans an extensive survey of springs in the Honey Lake Valley region during the next few years, in part to locate possible other populations of the tui chub (Chappell, 1992). As part of the baseline studies for this EIS, eastern Honey Lake Valley was surveyed for unmapped springs and seeps in the fall of 1989. None were found.

- *Cui-ui*

The cui-ui is a federally-listed endangered species endemic to Pyramid Lake. The cui-ui (and the Lahontan cutthroat trout discussed in the next section) are included in the discussion of listed and candidate species within the affected area because groundwater withdrawals in Honey Lake Valley could affect the amount and quality of water that enters Pyramid Lake (Section 4.4).

The cui-ui is a large sucker. It is a lake-dweller but can spawn only in flowing fresh water. The species has traditionally spawned only in the Truckee River, congregating each year at the river's mouth (Buchanan and Coleman, 1987). When spawning occurs, the adult cui-ui migrate a few miles upriver and spawn in shallow gravel beds. Young fish return to the lake generally within a few days after emerging from the spawning beds (Buchanan and Coleman, 1987).

The primary cause of the decline of the cui-ui has been disruption of their reproductive cycle (Scoppettone et al., 1986). Since completion of the Newlands Project in 1907, half of the flow of the Truckee River has been diverted at Derby Dam, about 40 miles upstream of Pyramid Lake, to the adjacent Carson River drainage and used for irrigation purposes (Buchanan and Coleman, 1987). During this century, the water level in Pyramid Lake has declined 80 feet and an extensive delta has formed at the mouth of the river (Scoppettone et al., 1986). In most years, river flows have been insufficient to form a negotiable channel across the delta to allow the cui-ui to move into the lower Truckee River to spawn. Because the cui-ui is long-lived (up to 41 years), the species has been able to take advantage of rare high-water years to reproduce (Buchanan and Coleman, 1987). Since 1950 there have been only three successful cui-ui spawning runs (Buchanan et al., 1985; FWS, 1992). Cui-ui are expected to spawn in the spring of 1993 (Buchanan, 1993).

The critical factor for re-establishment of a naturally reproducing population of cui-ui is maintenance of sufficient flow in the lower Truckee River to allow successful spawning (FWS, 1992). An increasing concentration of total dissolved solids (TDS) in Pyramid Lake is also a concern. Pyramid Lake is a terminal lake; dissolved salts entering the lake via the river and other sources remain there. The concentration of TDS in the lake depends upon the amount of water in the lake; TDS concentrations vary inversely with lake volume. During this century, the TDS of the lake has increased from about 3,500 ppm to 5,500 ppm (Sigler et al., 1985). It is believed that present concentrations of TDS are at or above the optimum for cui-ui and their algae and zooplankton food supply (Sigler et al., 1985).

- *Lahontan Cutthroat Trout*

The Lahontan cutthroat trout is a federally-listed threatened species that occurs in Pyramid Lake and the Truckee River. Like the cui-ui, the trout live in Pyramid Lake as adults, but reproduce only in the freshwater of the Truckee River. The original Pyramid Lake strain of Lahontan cutthroat trout became extinct in the 1940's due to diversions of the Truckee River for the Newlands Project (Sigler et al., 1983). Lahontan cutthroat trout were re-established in Pyramid Lake by hatchery propagation of strains of Lahontan cutthroat trout from Summit, Walker, and Heenan Lakes (Sigler et al., 1983).

As is the case for the cui-ui, re-establishment of natural reproduction for the trout will require maintenance of sufficient flows in the lower Truckee River during spawning. Derby Dam remains a barrier to trout migration upriver and spawning habitat for the trout in the lower river has been degraded by streambank erosion, channelization, and removal of streambank vegetation (Buchanan, 1987). With the present state of habitat in the lower Truckee River and current water diversions, even occasional achievement of the minimum river flows to maintain temperatures in the optimum range for the trout are unlikely (Buchanan, 1987). Virtually all Lahontan cutthroat trout recruitment in Pyramid Lake is now from the release of hatchery-reared fish (Buchanan, 1987).

The increasing concentration of TDS and total alkalinity in Pyramid Lake adversely affect the well-being of the Lahontan cutthroat trout, and could also be harmful to other species of fish and invertebrates in the lake that form the food chain for the trout (Sigler et al., 1983).

3.8 *WILD HORSES*

Five Herd Management Areas (HMAs) have been designated by the BLM between Honey Lake Valley and the Reno-Sparks metropolitan area for wild horses (Figure 3.8-1). Wild burros are managed in the Twin Peaks HMA north of Honey Lake Valley. U.S. Department of the Interior regulations under the Wild Horse and Burro Act of 1971 define an HMA as an area established for maintenance of wild horse and burro herds.

Wild horses occasionally range outside of designated HMAs. In order to control overgrazing, a partial removal of wild horses in Bedell Flat was conducted in the fall of 1991. This area is not part of a HMA, but it is between the Granite Peak and Dogskin Mountain HMAs. Since the removal, the frequency of horse sightings in Bedell Flat has declined (Axtell, 1992).

A July 1989 census of the Flanigan HMA counted 507 horses (BLM, 1989a; 1989b). During a February 1989 census, a lack of adequate forage was evident in the poor condition of the horses (BLM, 1989a). As a result of this information, as well as detailed analysis of five years of wild horse and rangeland monitoring data, the BLM established a management level of 104 horses for this HMA. This level allows for a healthy horse population within the area's carrying capacity. A subsequent roundup by BLM reduced horse numbers from 507 to 140 head.

The Dogskin Mountain and the Granite Peak HMAs each contain about 60 to 70 horses. The Lahontan Resource Management Plan sets management levels at 19 horses for the Dogskin Mountain HMA and 17 horses for the Granite Peak HMA. These management levels were established under the Dogskin Mountain/Granite Peak Wild Horse Removal Plan (BLM, 1988a). Horses outside the HMA were captured and removed.

In the past, wild horses were present in the Pah Rah Range. In 1985 the BLM implemented a 100 percent capture plan for this area (Murray, 1990). These horses were removed to prevent damage to private land in conformance with existing law.

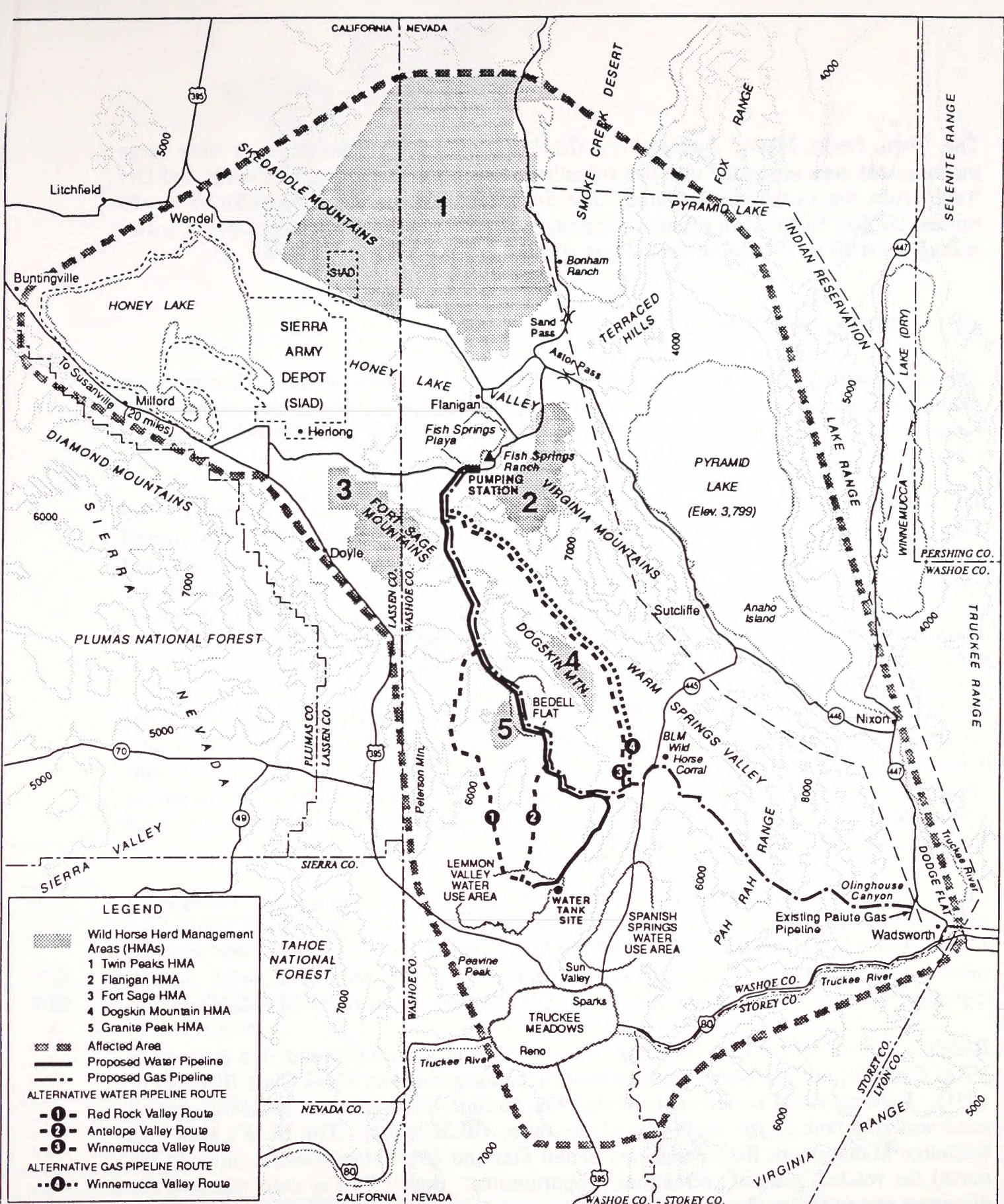


Figure 3.8-1

Wildhorse Herd Management Areas in Affected Area



0 5
MILES

Contour Interval = 1,000 feet

The Twin Peaks HMA, managed by the Susanville BLM District, is a very large management area separated into five subunits. Parts of two subunits, Skedaddle and Dry Valley Rim, are in the affected area. The Skedaddle sub-unit is managed for 75 to 108 horses; the Dry Valley Rim sub-unit is managed for 50 to 72 horses. Each sub-unit is also managed for 10 to 15 wild burros (Visser, 1992).

3.9 *VISUAL RESOURCES*

The visual setting of the affected area is characterized by north trending, discontinuous mountain ranges separated by wide valleys (Figure 3.9-1). The valleys provide unobstructed views of the surrounding mountains, whereas the higher mountains offer broad vistas of adjacent valleys, as well as distant mountains and valleys.

The visual character of the landscape varies widely in form, line, color, and texture. The proposed and alternative pipeline routes pass through wide valleys and rolling hills covered with the gold, brown, and grey-green hues of sagebrush, rabbitbrush, bunchgrass, and cheatgrass. Mountain passes in the Pah Rah, Fort Sage, and Virginia Mountains are sparsely populated with dark-green Utah juniper which are visible from long distances. Landscapes in Honey Lake Valley include irrigated alfalfa fields, playas, and hills and valleys covered with sagebrush, rabbitbrush, and greasewood.

The BLM uses a Visual Resource Management (VRM) system to classify and protect the quality of scenic and visual resources on public lands (BLM, 1980; 1984b; 1986, 1986a). Public lands can be assigned to one of four VRM classes (Table 3.9-1). The visual impacts from proposed projects and structures that would affect VRM Classes I and II are strictly controlled by the BLM. Areas assigned VRM Classes III and IV can accommodate visual intrusion, but the intrusions are carefully scrutinized to minimize impacts.

Public lands along the proposed and alternative pipeline routes are entirely within areas assigned to VRM Classes III and IV. The Skedaddle Mountains Wilderness Study Area (WSA) and Dry Valley Rim WSA to the north of Honey Lake Valley have been assigned interim Class II status. Higher elevations of the Skedaddle Mountains WSA provide expansive vistas to the south into Honey Lake Valley and the surrounding mountains.

Bedell Flat is one of the few remaining undisturbed valleys north of Reno; it is assigned to VRM Class IV, but has been recommended for re-assignment to VRM Class III (Abbett, 1991). Existing visual intrusions in Bedell Flat include dirt roads and an above-ground stock-watering tank at the south end of the valley (BLM, 1984). The BLM's Lahontan Resource Management Plan designates Bedell Flat and Dry Valley (several miles to the north) for roaded, general recreational opportunities. Bedell Flat is used regularly for dispersed recreation by Reno-Sparks residents.

The Incandescent Rocks scenic area is located in the Virginia Mountains just north of State Highway 445. The Red Rock scenic area is located near Red Rock Valley north of Petersen Mountain.

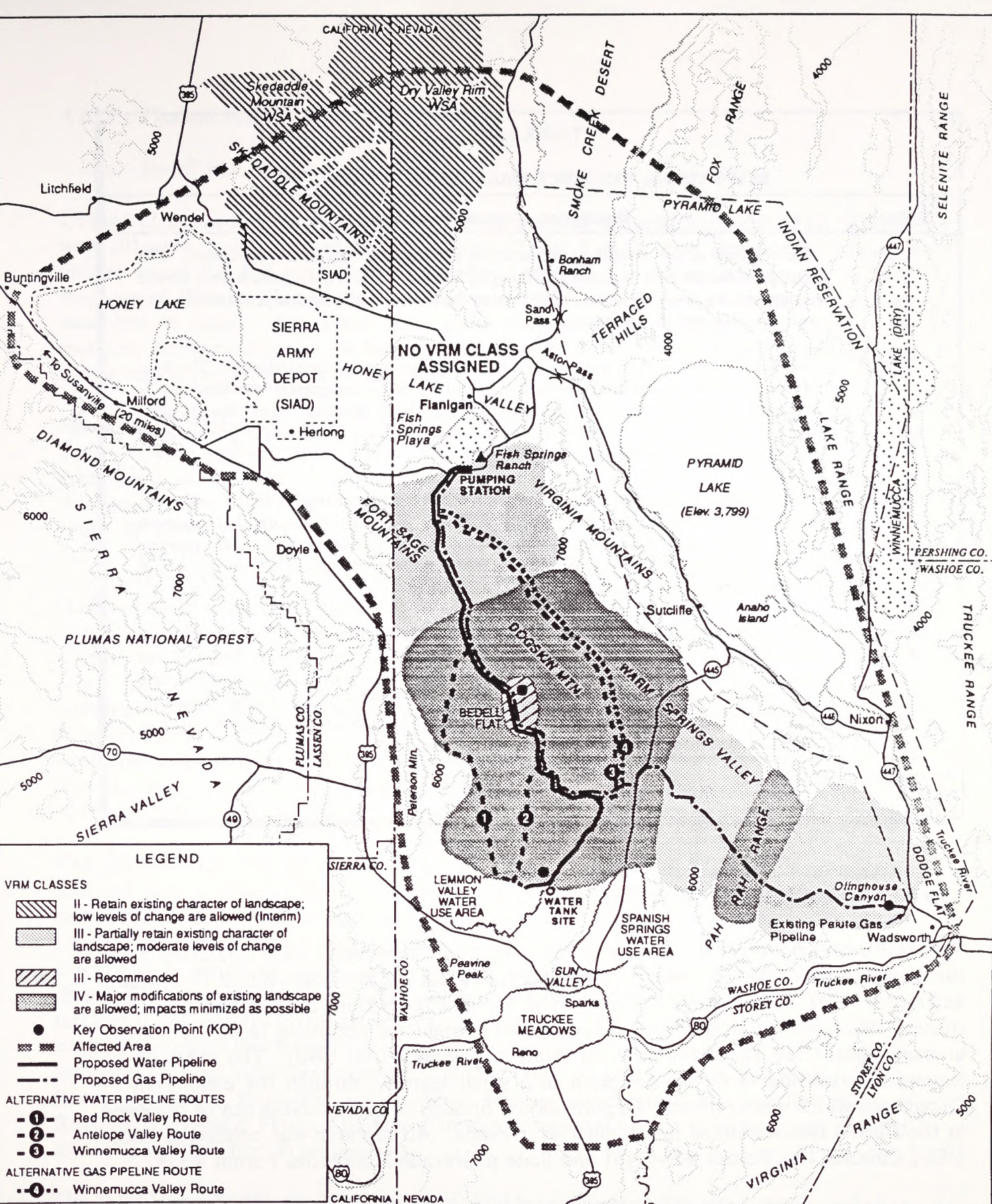


Figure 3.9-1

Visual Resources in the Affected Area

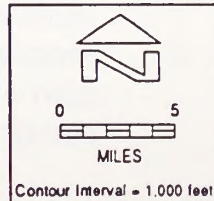


TABLE 3.9-1

BLM'S VISUAL RESOURCE MANAGEMENT CLASSES^(a)

Rating	Description of Management Objectives
Class I	The objective of this class is to preserve the existing character of the landscape. This class provides for natural ecological changes; however, it does not preclude very limited management activity. The level of change to the characteristic landscape should be very low and must not attract attention.
Class II	The objective of this class is to retain the existing character of the landscape. The level of change to the characteristic landscape should be low. Management activities may be seen, but should not attract the attention of the casual observer. Any changes must repeat the basic elements of form, line, color and texture found in the predominant natural features of the characteristic landscape.
Class III	The objective of this class is to partially retain the existing character of the landscape. The level of change to the characteristic landscape should be moderate. Management activities may attract attention but should not dominate the view of the casual observer. Changes should repeat the basic elements found in the predominant natural features of the characteristic landscape.
Class IV	The objective of this class is to provide for management activities which allow for major modification of the existing character of the landscape. The level of change to the characteristic landscape can be high. These management activities may dominate the view and be the major focus of viewer attention. However, every attempt should be made to minimize the impact of these activities through careful location, minimal disturbance and repeating the basic elements.
^(a) Source: BLM, 1986a	

3.10 CULTURAL RESOURCES

Surveys for historic (post-1492) and prehistoric (pre-1492) resources were conducted along the entire length of the proposed routes of the water and gas pipelines (Kautz 1990, Kautz and Pinto, 1990). Surveys were also conducted on public lands along the alternative pipeline routes (Mires and Kautz, 1991). All surveys were conducted according to standard BLM archaeological Class III survey methods (Hardesty, 1986; BLM, 1990). The width of the surveys was 100 feet with the exception of a small segment through the community of Olinghouse which was narrower. Reports on the findings of these surveys can be reviewed at the BLM's District Office in Carson City, Nevada. All research was conducted under USDI Cultural Use Permit #N-49481 and State of Nevada Antiquities Permit #318.

3.10.1 Pipeline Routes

• Bedell Flat Route

Of the 112 archaeological sites discovered along and near the proposed Bedell Flat rights-of-way, 101 were prehistoric and 11 were historic (Table 3.10-1). Two of the prehistoric sites and seven of the historic sites are considered eligible for nomination to the National Register of Historic Places. As such, they are considered to be significant sites and are described in detail. All of the other prehistoric and historic sites are deemed to be ineligible for nomination to the National Register of Historic Places (NRHP) and they are not discussed further in this document.

Significant Prehistoric Sites:

Two significant prehistoric sites were discovered near the route of the proposed gas pipeline: the Cottonwood Creek site (CrNV-31-4256) and the Wild Horse Spring site (CrNV-31-4261). These are both Native American sites adjacent to water sources on the

west side of the Pah Rah Range where the gas route descends into Warm Springs Valley. The gas pipeline would pass 100 feet north of the Cottonwood Creek site and 200 feet north of the Wild Horse Spring site.

TABLE 3.10-1
**ARCHAEOLOGICAL SITES ALONG AND NEAR THE PROPOSED
AND ALTERNATIVE PIPELINE ROUTES**

Route	Total Prehistoric Sites	Total Historic Sites	Total Significant Prehistoric	Total Significant Historic
Bedell Flat	101	11	2	7
Winnemucca Valley	72	11	4	7
Antelope Valley	92	11	2	7
Red Rock Valley	95	12	4	7

The Cottonwood Creek site measures 130 by 200 feet. It contains flake scatter with flaked tool and ground stone artifacts. The site has been looted and otherwise disturbed by road construction. It is deemed significant because of its location on the first terrace above Cottonwood Creek, along with evidence of both plant and animal processing and fire-cracked rock, which suggests quasi-permanent occupation and perhaps the presence of a diverse set of people. Little is known about streamside adaptations away from major river terraces in the western Great Basin. Partially buried artifacts at the site, including metate fragments, suggest that temporally diagnostic materials may lie below the surface. This site has been deemed significant because it is older than 50 years, retains adequate integrity (location, setting, materials, workmanship, feeling, association), and satisfies National Register of Historic Places *Criterion d* in that it has yielded, or may be likely to yield, information important to prehistory.

The Wild Horse Spring site is located near Wild Horse Spring. The site is composed of an extensive and, in places, dense scatter of flaked stone including obsidian, cryptocrystalline silicate, and basalt, as well as stone tools including projectile points and groundstone artifacts. In addition, several rock features were observed that may represent house rings and/or fire hearths. Although the site has been disturbed, part of it retains its integrity and

may offer information pertinent to a reconstruction of the cultural history and past life of the people who lived there. The presence of the spring may also offer the opportunity to provide a paleoenvironmental context by means of pollen and/or other environmental studies. As such, this site has been deemed significant in that it is older than 50 years, has retained site integrity, and satisfies National Register of Historic Places *Criterion d* in that it has yielded, or may be likely to yield, information important to prehistory.

Significant Historic Sites: Seven significant historic sites were found in Olinghouse Canyon. These sites are within several hundred feet of the proposed route of the gas pipeline. The sites are all associated with early-Nevada mining and the railroad industry.

1. Garaventa Ranch - This historic complex was initially occupied as early as 1905, with additional structures added just prior to WWII. It is composed of a small ranch house, root cellar, cattle-loading chute and stock pen, a collapsed structure of undetermined function, a small cabin built of railroad ties, collapsed fencing of juniper posts and barbed wire, and an extensive scatter of historic trash. Literature indicates that the house was built in 1905 by Mr. Heinerich with the addition of a fireplace that was added by Mr. Garaventa prior to 1940. It served as both a CCC camp and dude ranch prior to 1940 and was abandoned some time after 1955. The site has been deemed significant because it represents a series of economic endeavors important to the history of Nevada (ranching, CCC camp, mining, dude ranch), and is older than 50 years and is still in fair condition. The site has been recommended eligible under National Register *Criterion d*, as it is likely to yield information important to history.

2. Mining Dump - This small dump measuring 50 by 130 feet is located south of the road leading into Olinghouse Canyon near the Green Hill mine. The site is a bottle and can dump dating from the early 1900s to as late as 1940. This site is officially unevaluated, but it could provide insight into the social dynamics of the early phases of mining in Olinghouse Canyon. As such, it is deemed to be significant under National Register *Criterion d*, in that the site is likely to yield information important to history.

3. Rock Wall Feature - This site is composed of two rock walls along both sides of an ephemeral creek. It is associated with either an early road leading into Olinghouse Canyon or to the narrow-gauge Nevada Railroad Company that provided services to the Olinghouse mining district. The wall is constructed of dry wall cobbles and boulders complete with a wood plank atop the wall. The present road is also supported by this wall. The site may be determined eligible under National Register *Criterion d*, in that it is likely to yield information important to history.

4. Nevada Railroad Ramp - This site is apparently a loading ramp associated with the historic Nevada Railroad Company that operated a narrow-gauge railroad for about one year in Olinghouse Canyon in the early 1900s. It is made of dry wall cobbles and boulders and is earth filled. The railroad's roadbed leading to the site has several rock-wall supports. Due to the site's association with early mining in Nevada, it was determined eligible under National Register *Criterion d*, in that it is likely to yield information important to history.

5. *Olinghouse Dump Site* - The dump measures 100 by 100 feet and contains cans, bottle glass, ceramics, and the remains of crucibles. The density and broad range of artifact forms contained within this domestic and industrial dump, as well as the dating of this dump to the early 1900s, lead to the determination that this site is eligible under National Register *Criterion d*, in that it is likely to yield information important to history.

6. *Renegade Mine Site* - This site is the relic component of the historic Renegade mine. The site is composed of a rock retaining wall that supports an earth filled ramp, a wooden ore chute located in the center of the ramp, two small wooden cabins, and one outhouse. A still-functioning metal water tank occurs below the ore chute. Because this site relates to early historic mining in Olinghouse Canyon, it has been determined eligible under National Register *Criterion d*, in that it is likely to yield information important to history.

7. *Olinghouse Industrial Complex* - This site is an historic residential and industrial complex on the south side of Olinghouse Canyon. The complex consists of one wood-plank house, a spring house, and a concrete and stone machine foundation. All these components were evidently in place near the turn-of-the-century. Trash dumps associated with the complex extend uphill west and south of the house and provide the opportunity to help reconstruct information regarding the social, economic, and cultural history of an industrial site in Olinghouse Canyon. As such, this site has been determined eligible under National Register *Criterion d*, in that it is likely to yield information important to history.

• *Winnemucca Valley Route*

A total of 72 prehistoric and 11 historic sites occur along and near the water and gas pipeline routes for the Winnemucca Valley alternative. Four of the prehistoric sites and seven of the historic sites are considered eligible for nomination to the National Register of Historic Places.

All of the other prehistoric and historic sites along this route are deemed to be ineligible for nomination to the National Register of Historic Places (NRHP) and they are not discussed further in this document.

Significant Prehistoric Sites: Two significant prehistoric sites, in addition to the Cottonwood Creek site and the Wild Horse Spring site described under the proposed Bedell Flat route, were found in Winnemucca Valley. These are the Warm Springs Valley site (CrNV-31-3247) and the Winnemucca Valley site (CrNV-31-4364). These are both Native American sites near water sources in Warm Springs and Winnemucca Valleys. The water and gas pipelines would pass through each of these sites.

The Warm Springs Valley site encompasses at least 400 acres near springs on the west side of Warm Springs Valley. Parts of the site have been collected over many decades by private collectors. Review of one collection revealed early to late Archaic Period projectile points and many groundstone artifacts. Surveys of the site recorded five projectile points, three biface fragments, two mano fragments, an atlatl weight, and a possible retouched green glass fragment. The site is located along a probable prehistoric route between the Truckee Meadows and Pyramid Lake. Its broad range of artifact forms and functions, its huge area,

the presence of temporally sensitive artifacts, and the possibility that the site contains artifacts at depth, all contributed to its assessment as significant. The site satisfies National Register of Historic Places *Criterion d* in that it has yielded, or may be likely to yield, information important to prehistory.

The Winnemucca Valley site is a dense prehistoric lithic scatter located along the Winnemucca Ranch road. It measure 1,300 by 700 feet and contained two Cottonwood projectile point fragments, four biface fragments, a core, a broken mano, and a concentration of flake debitage. Though the site has been disturbed by cattle and road construction, it is still in good condition. The distribution of surface materials and the depositional context in which the site is located suggest the possibility of buried materials. This site satisfies National Register of Historic Places *Criterion d* in that it has yielded, or may be likely to yield, information important to prehistory. It has been evaluated as a significant prehistoric resource eligible for nomination to the National Register.

Significant Historic Sites: Historic sites along the Winnemucca Valley route are the same ones as those already described under the proposed Bedell Flat route.

- ***Antelope Valley Route***

A total of 92 prehistoric and 11 historic sites occur near the water and gas pipeline routes for the Antelope Valley alternative. Two of the prehistoric sites and seven of the historic sites are considered eligible for nomination to the National Register of Historic Places. These are the same sites as those already described under the proposed Bedell Flat route.

All of the other prehistoric and historic sites along this route are deemed to be ineligible for nomination to the National Register of Historic Places (NRHP) and they are not discussed further in this document.

- ***Red Rock Valley Route***

A total of 95 prehistoric and 12 historic sites occur along and near the water and gas pipeline routes for the Red Rock Valley alternative. Four of the prehistoric sites and seven of the historic sites are considered eligible for nomination to the National Register of Historic Places. These are the same sites as those already described under the Winnemucca Valley route.

All of the other prehistoric and historic sites along this route are deemed to be ineligible for nomination to the National Register of Historic Places (NRHP) and they are not discussed further in this document.

3.10.2 *Water Source Area*

The sites for the ancillary facilities in Honey Lake Valley, including the wells, pump station, storage tanks, and the telemetry building, were surveyed for cultural resources (Kautz, 1992). Ten isolated sites were discovered, all of which contributed limited information regarding

their form and location. No further archaeological investigation of these isolates is recommended.

Three prehistoric sites were discovered on private lands near Fish Springs Ranch. All three sites were judged ineligible for nomination to the NRHP.

3.10.3 *Delivery/Use Area*

Neither Lemmon Valley nor Spanish Springs Valley were surveyed for cultural resources as part of the proposed action. Although the proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for population growth in these valleys, the precise locations of growth-related disturbances are unknown and descriptions of cultural resources are beyond the scope of this EIS.

3.11 *RECREATION*

Recreational activities and opportunities within the affected area are diverse. They include hiking, backpacking, exploring, sightseeing, wild-horse viewing, horseback riding, target shooting, hunting and fishing, rock and mineral collecting, car camping, historic and archaeological sightseeing, and the use of off-road vehicles (ORVs) (BLM, 1982; 1987). Day-use of recreation areas is most common. Numerous recreational opportunities are available at Pyramid Lake including boating and fishing. Figure 3.11-1 shows some of the popular recreation areas in the affected area.

The most popular form of recreation in the vicinity of the proposed and alternative pipeline routes is the use of ORVs (BLM, 1982). These areas are popular because of their proximity to the Reno-Sparks metropolitan area and because they contain a network of dirt roads and trails. Areas such as Petersen Mountain, Red Rock Scenic Area, the Pah Rah Range, and Incandescent Rocks Scenic Area in the Virginia Mountains provide dispersed, non-motorized and semi-primitive recreational opportunities (BLM, 1982).

Eastern Honey Lake Valley and surrounding areas are rural and sparsely populated. Two areas with relatively high recreational use are the Skedaddle Mountains Wilderness Study Area (WSA) and the Dry Valley Rim WSA. Hunting is the most popular activity within these WSAs. Hunter use is estimated at 4,200 visitor-days per year within the Skedaddle Mountains WSA and 3,600 visitor-days per year within the Dry Valley Rim WSA (BLM, 1987).

Other recreational activities in the valleys immediately north of the Truckee Meadows include a 527-acre regional shooting facility in Warm Springs Valley operated by Washoe County, and the Hungry Valley ORV area administered by the BLM. Several community and neighborhood parks are also located in Lemmon Valley and Spanish Springs Valley to serve the existing population of these areas. A major network of open space, parks, and recreational facilities is planned to accommodate population growth in Spanish Springs Valley.

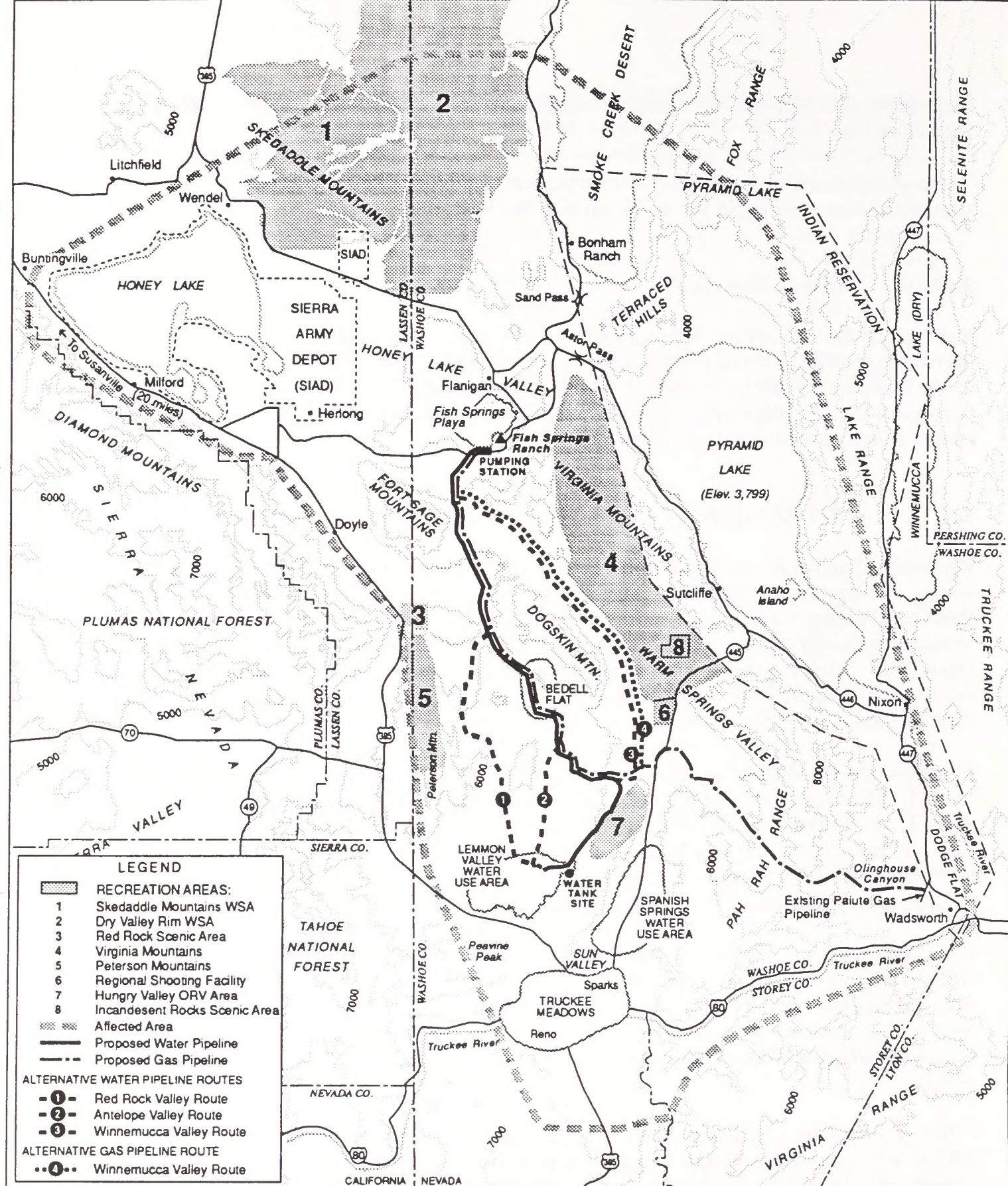
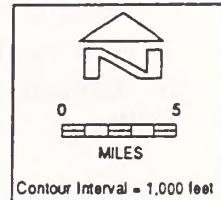


Figure 3.11-1

Recreation Resources in the Affected Area



3.12 *LIVESTOCK GRAZING*

Grazing of domestic livestock is a common use of public and private lands within the affected area. Grazing is becoming less common on private lands in the valleys immediately north of the Reno-Sparks metropolitan area as these lands are increasingly being subdivided into smaller parcels for residential development.

Rangeland in the affected area is composed primarily of big sagebrush, low sagebrush and salt desert shrub vegetation communities. There is also some irrigated crop and pasture land, as well as areas of urban development.

The primary class of livestock in the affected area is cattle along with some sheep north of Honey Lake Valley. Most operators run cow-calf operations, selling their annual calf crop except for a few replacement heifers (Wolfe, 1991). The season of use is variable and includes spring, summer, fall, or winter. Year-long grazing has been eliminated by the BLM to improve range conditions. Reductions in livestock grazing preference have also been instituted by the BLM in order to improve range conditions. It is estimated that within the affected area 42,549 Animal Unit Months (AUMs) are available on public lands for cattle and 3,650 AUMs are available for sheep. This is equivalent to about 3,150 head of cows on an annual basis. The grazing preference for sheep in the affected area is about 1,520 head on an annual basis.

Sixteen livestock grazing allotments occur in the affected area (Figure 3.12-1). Table 3.12-1 contains information about the allotments, the permittees, and other grazing information (BLM, 1982; 1984a; 1989).

The Antelope Mountain, Big Canyon, Flanigan, Paiute, Winnemucca Ranch, Winter Range, and Twin Peaks allotments have been assigned to the "intensive or improvement" category (BLM, 1982a, 1982b, 1989). Allotments in this category are considered a management priority because the potential exists to increase rangeland productivity, resolve multiple-use problems, and reduce resource conflicts. The Olinghouse Canyon, Pah Rah, Spanish Springs-Mustang, White Hills, and Wedekind allotments are assigned to the "custodial" category (BLM, 1982a, 1982b, 1989). Public and private lands are intermingled in these allotments. The custodial allotments are managed less intensively and require fewer range improvements than other categories of allotments. The remaining allotments are designated as maintenance allotments. They are managed to maintain their current satisfactory conditions.

3.13 *MINERALS*

Unless stated otherwise, the minerals data presented in this chapter are from Bonham and Papke (1969), U.S. Geological Survey and Nevada Bureau of Mines (1964), and Tingley (1990).

TABLE 3.12-1

1992 GRAZING ALLOTMENTS IN THE AFFECTED AREA^(a)

Allotment Name	Permittee(s)	Grazing Preference ^(b) Active AUMs ^(c)	Season of Use	Wild Horse HMA ^(d)
Antelope Mountain	Feather River Ranch	6,360C	04/15 - 10/31	Granite Peak
Big Canyon	Herb Capurro	3,050C	04/01 - 12/31	---
Flanigan	Harry G. Browne	5,015C	03/01 - 10/31 12/01 - 02/28	Flanigan
Ft. Sage	Ken & Roy Bogart	67C	04/16 - 05/31	Ft. Sage
	S.L. Robinson	160C	04/16 - 10/31	"
	Felix Garnier	170C	04/01 - 08/31	"
	Garnier Estates	255C	04/01 - 08/31	"
	Harry Browne	190C	04/01 - 10/31	"
Hard Scrabble	Ed Horgan	1,222C	03/01 - 10/31	---
Olinghouse Canyon	DePaoli Bros.	100C	11/01 - 05/15	---
	Judy & Jack Bassett	596C	11/01 - 04/30	---
Pah Rah Mountain	DePaoli Bros.	184C	09/01 - 12/31	----
Paiute Canyon	Intermountain Land and Cattle Company	4,798C	03/01 - 02/28	Dogskin Mtn.
Red Rock	Feather River Ranch	454C	04/15 - 10/31	---
Spanish Springs - Mustang	DePaoli Bros.	1,086C	11/1 - 3/31	---
	Allen Oppio	429C	4/16 - 11/30	---
Twin Peaks	Laver Ranch	10,500C	03/01 - 12/01,C	Twin Peaks
	Partnership	2,850S	04/01 - 05/30	
	Espil Sheep Co.		06/01 - 06/30	
			09/16 - 01/25,S	
Wedekind	Spanish Springs Ranch, Alan Capurro	123C	04/15 - 06/15	---
White Hills	DePaoli Bros.	1,210C	04/16 - 10/31	---
Winnemucca Ranch	Dalton La Rue	5,280C	04/20 - 11/30	---
Winter Range ^(e)				
1. Nevada (C&S)	Fish Springs Ranch,	1,300C	11/01 - 03/31,C	---
2. Calif. (S only)	John Torvik, Espil Sheep Co., Pierre Mendiboure	800S	01/10 - 04/10,S	---
Total		42,549C	---	---
		3,650S		

^(a) Data from BLM, Carson City and Susanville Districts^(b) Animal Unit Months: Forage for one cow and calf for a month; or five ewes and lambs for a month^(c) C - Cattle S - Sheep^(d) HMA - Herd Management Area^(e) There are two Winter Range allotments, one in Nevada and one in California. Sheep are trailed through both allotments.

- ***Metallic Minerals***

A wide variety of metallic mineral deposits occur in the vicinity of the proposed and alternative pipeline routes. Gold, silver, lead, copper, and zinc have been the main metals produced in Washoe County, although the county has never been a major producer of metallic ores. Minor amounts of mercury, uranium, tungsten, arsenic, and antimony have also been produced, and occurrences are known of tellurium, manganese, molybdenum, bismuth, titanium, rare-earth, and thorium. No metallic mining is currently occurring along the proposed or alternative pipeline routes. The Butcher Boy placer gold mine is an active operation located a few miles east of Olinghouse Canyon and about 0.5 miles north of the proposed route of the gas pipeline.

Gold and silver have been produced from the Olinghouse mining district located at the east end of the proposed gas pipeline. Mining from the district began in the 1870s and peaked in the early 1900s. Small but steady amounts of gold and silver have been produced from the district up to recent times. The most recent operation in the district was at the Green Mountain mine several miles north of the proposed pipeline. By 1988 operations at the mine had shut down and some of the mining equipment had been sold. Small amounts of tungsten were also produced from the district in the early 1940s.

The Pyramid mining district, located in the Virginia Mountains several miles east of the Warm Springs Valley alternative pipeline route, has produced small amounts of gold and silver beginning in the 1860s and continuing to recent times. Uranium was discovered in the district in 1954 and small amounts were produced through the 1960s.

The Stateline mining district, centered on Petersen Mountain next to the Red Rock Valley alternative water pipeline route, has produced small quantities of gold, silver, and copper from numerous small pits and shafts. The last recorded production was during the early 1940s. Uranium was discovered in the district in 1954 and shipments were made during the following two years.

- ***Industrial Minerals***

Several industrial minerals and materials occur in the vicinity of the proposed and alternative pipeline routes. Within Washoe County, the mining and processing of industrial rocks and minerals has far exceeded the value of metallic minerals. Materials known to occur in the vicinity of the pipeline routes include calcium carbonate, diatomite, feldspar, and lightweight aggregate. With the exception of the Sha-Neva sand pit on Chickadee Drive in Lemmon Valley, no large-scale mining of industrial minerals and materials is currently occurring along the proposed or alternative pipeline routes.

- ***Mining Claims***

Numerous patented and unpatented mining claims exist in the area. Most are in the vicinity of the three mining districts described in the preceding paragraphs. Along the pipeline routes, mining claims are more likely to occur where these routes cross bedrock, and least

likely to occur where the routes cross alluvial-filled valleys. Many unpatented mining claims occur in the vicinity of the proposed gas pipeline in the Olinghouse Canyon area.

3.14 LAND USE

Refer to Figures 3.14-1 and 3.14-2 for the location of lands discussed in this section.

3.14.1 Pipeline Routes

- ***Proposed Bedell Flat Route***

The Bedell Flat route would require 77.5 miles of trenching for the water and gas pipelines. Fifty-three percent of the route would cross public land. The remaining 47 percent would cross private lands, the bulk of which are along the route of the gas pipeline between Olinghouse Canyon and northern Hungry Valley.

The public lands along the Bedell Flat route are open spaces that are used for recreation, watershed protection, wildlife habitat, livestock grazing, and mineral exploration and development. The private lands are used chiefly for ranching, agriculture, and low-density housing. Pipeline construction on private lands would be largely along county rights-of-way associated with existing dirt roads. Some private lands would be required for pipeline construction where no county rights-of-way now exist. The Reno-Sparks Indian Colony abuts the route of the water pipeline in Hungry Valley. About 330 people currently live in 98 houses at the Colony.

- ***Winnemucca Valley Route***

The Winnemucca Valley route would require 76.5 miles of trenching for the water and gas pipelines. Thirty-eight percent of the route would cross public land. The remaining 62 percent would cross private lands, the bulk of which are along the route of the gas pipeline between Olinghouse Canyon and northern Hungry Valley, and in Winnemucca Valley.

The public and private lands along this route are used for the same purposes as the public and private lands along the proposed Bedell Flat route. The water pipeline would also cross next to the Reno-Sparks Indian Colony in Hungry Valley.

- ***Antelope Valley Route***

The Antelope Valley route is very similar to the Bedell Flat route, with the exception that the water pipeline would pass through large blocks of private land, Antelope Valley rather than extend through the largely public lands in Hungry Valley. This route would avoid the Reno-Sparks Indian Colony in Hungry Valley. The Antelope Valley route would require 79 miles of trenching for the water and gas pipelines. Forty-five percent of the route would cross public land. The remaining 55 percent would cross private lands.

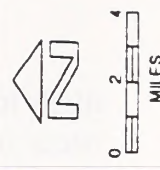
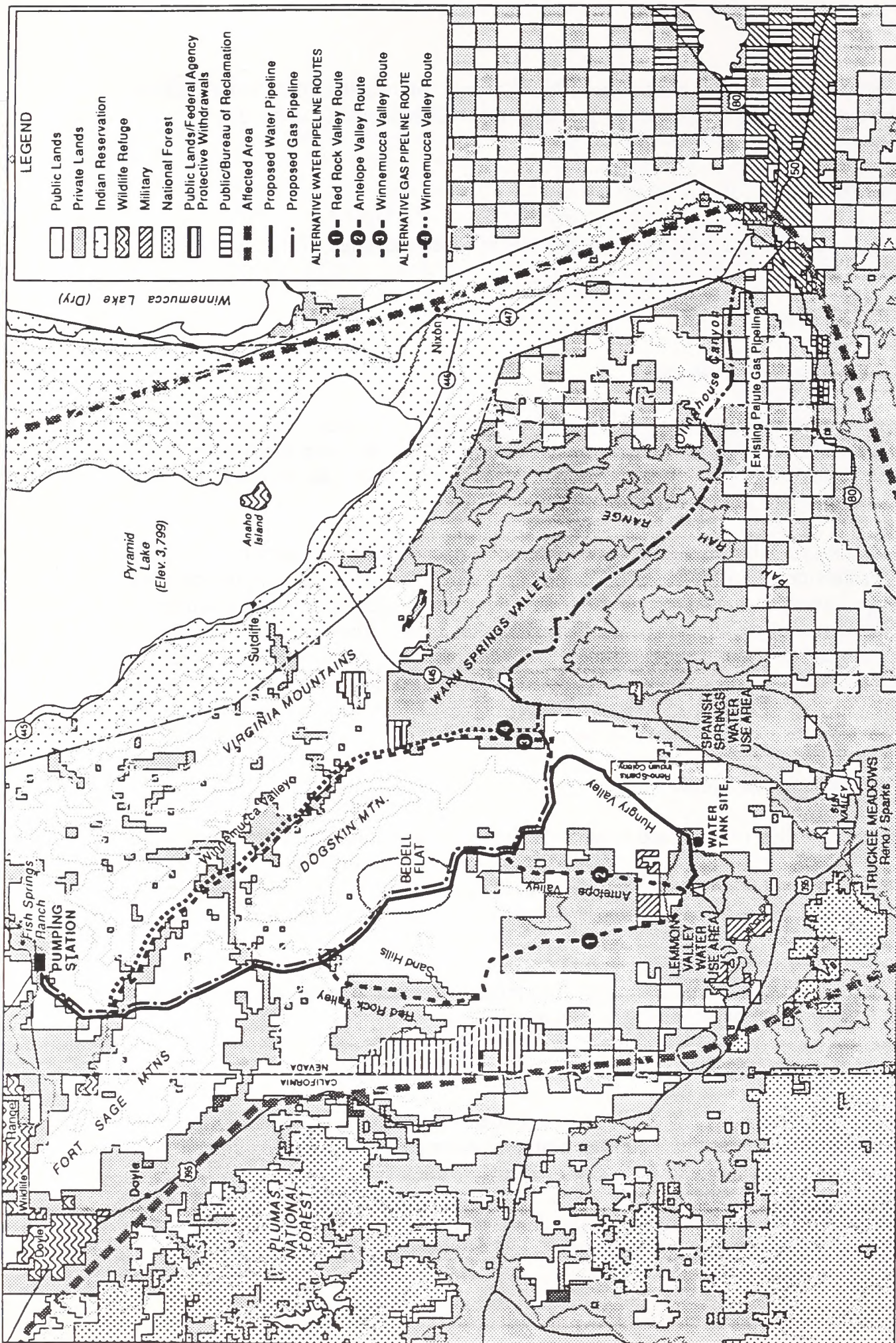
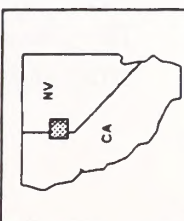


Figure 3.14-1

Land Status in the Vicinity of Pipeline Routes



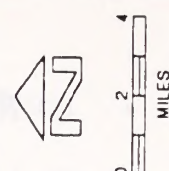
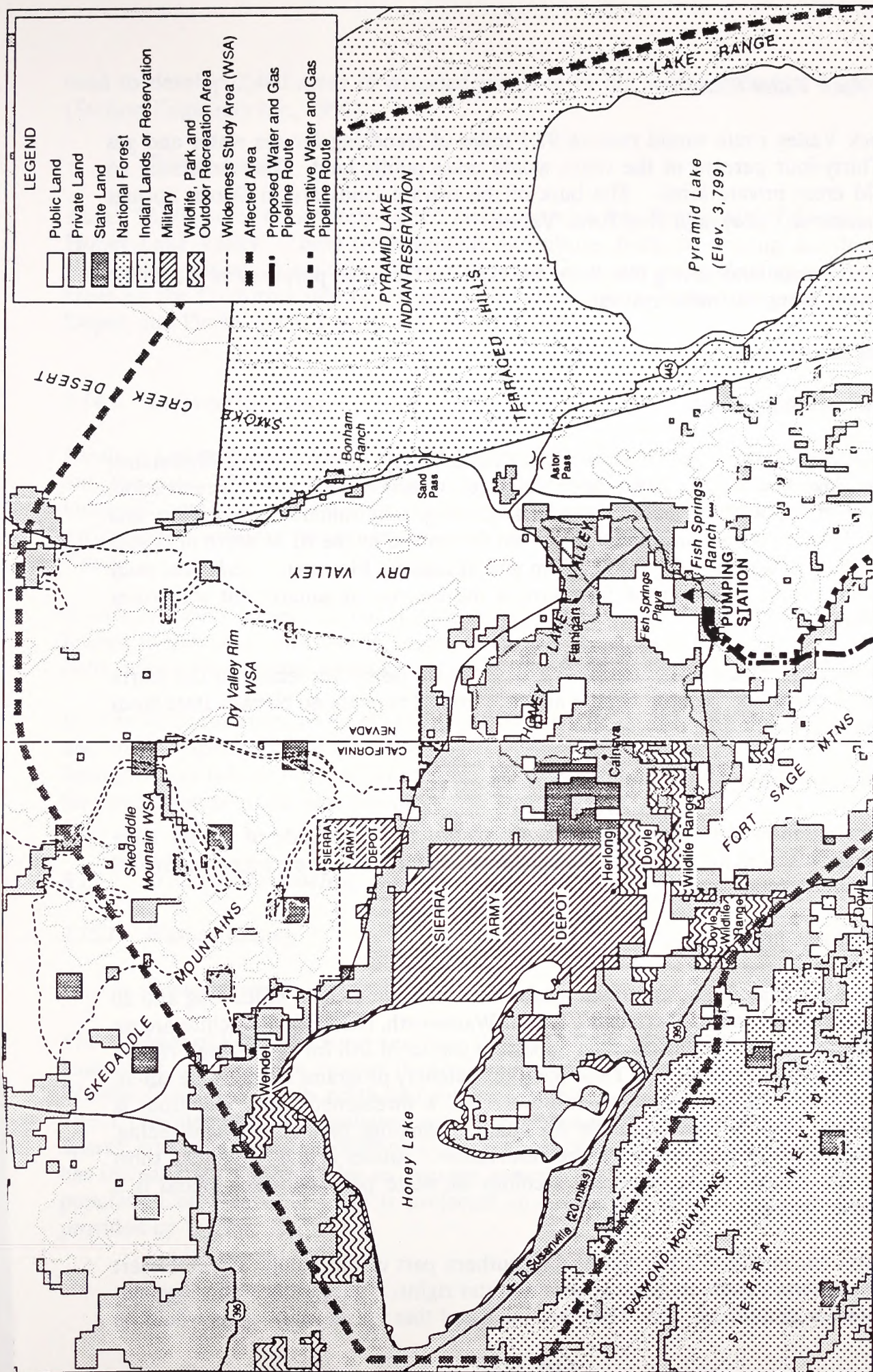
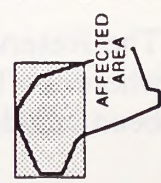


Figure 3.14-2

Land Status of the Water Source Area



- *Red Rock Valley Route*

The Red Rock Valley route would require 97.1 miles of trenching for the water and gas pipelines. Thirty-four percent of the route would cross public land. The remaining 66 percent would cross private lands. The bulk of the private lands are in Warm Springs Valley, Winnemucca Valley, and Red Rock Valley.

The public and private lands along this route are used for the same purposes as the public and private lands along the other routes.

3.14.2 *Water Source Area*

- *Public and State Lands*

Large blocks of public land occur north of Honey Lake Valley, in the Virginia Mountains, and in the Fort Sage Mountains. These lands are largely vacant and are used for recreation, watershed protection, wildlife habitat, livestock grazing, and mineral exploration and development. Two *wilderness study areas* have been designated by the BLM north of Honey Lake Valley. Parts of both the Dry Valley Rim and Skedaddle Mountains *wilderness study areas* have been recommended to the Secretary of the Interior as suitable for wilderness designation (Teeter, 1992).

California state lands occur largely in Honey Lake Valley. Some are leased to the Sierra Army Depot and others are used for wildlife management. There are no Nevada state lands in the water source area.

- *Sierra Army Depot*

The U.S. Army operates the Sierra Army Depot on the California side of Honey Lake Valley. The Depot is used for storage and disposal of ammunition. It encompasses 96,000 acres, and includes Honey Lake.

- *Pyramid Lake Reservation*

The Pyramid Lake Indian Reservation was established in 1859. It is 60 miles long and 20 miles across at its widest point. The small towns of Wadsworth, Nixon, and Sutcliffe are on the reservation. Pyramid Lake has been an important source of fish for the region's Native Americans for many generations. The Tribe operates hatchery programs for both the cui-ui, an endangered fish, and the Lahontan cutthroat trout, a threatened fish. The trout is popular for fishing, and the lake is popular for boating, camping, hiking, and sight-seeing. Limited livestock grazing also occurs on the reservation. Anaho Island, located a short distance from the eastern shore, supports a colony of white pelicans. The island is a National Wildlife Refuge.

The Reservation encompasses a portion of the southern part of the Smoke Creek Desert where the Tribe asserts a claim to reserved groundwater rights. These water rights have not been adjudicated or quantified. The Tribe has indicated that these water rights would be

used to develop 2,480 acres of irrigated cropland in the southern Smoke Creek Desert (Stetson Engineers Inc., 1990).

- ***Private Lands***

About 78,000 acres of privately-owned lands occur on the Nevada and California sides of Honey Lake Valley. These lands support agriculture, livestock grazing, and low-density residential housing. A majority of the private land is vacant and undeveloped. Residential areas on the California side of the valley include Herlong, located near the Sierra Army Depot, and Doyle, located along U.S. Highway 395.

3.14.3 Delivery/Use Area

Lands in Lemmon and Spanish Springs Valleys are within unincorporated Washoe County and the cities of Reno and Sparks. These lands support multiple land-uses including industrial/commercial developments, single and multi-family residential housing, and agriculture. Currently, these uses are centered largely in Stead, which is part of the City of Reno.

Residential development in out-lying parts of Lemmon and Spanish Springs Valleys is limited to parcels of one acre or more. There are some areas of high-density housing in both valleys. Residential development densities are substantially higher in Stead.

Increased urbanization, primarily residential housing, is planned for both Lemmon Valley and Spanish Springs Valley (Washoe County, 1991a; 1991b). The southern part of Spanish Springs Valley falls within the City of Spark's sphere-of-influence; most of this area is slated for annexation over the next several years (SEA Inc. et al., 1991).

3.15 SOCIOECONOMICS

3.15.1 Washoe County

- ***Demographics***

The majority of Washoe County residents live in the Reno-Sparks metropolitan area. The balance of the populace resides in rural and suburban communities in unincorporated Washoe County, primarily north and south of the Reno-Sparks metropolitan area. Table 3.15-1 provides historic population counts for Washoe County, the Cities of Reno and Sparks, and unincorporated Washoe County. Since 1980, the population of Washoe County has increased 31.5 percent, for an average annual growth rate of about 3.0 percent. The population of Washoe County is projected to exceed 400,000 by the year 2015 (data provided by Washoe County).

TABLE 3.15-1

POPULATION OF WASHOE COUNTY, RENO, AND SPARKS: 1980 AND 1990

Area	1980	Percent of Total	1990	Percent of Total	Percent Change 1980-1990
Reno	100,756	52.0	133,850	52.6	32.8
Sparks	40,780	21.1	53,367	20.9	30.9
Unincorporated Washoe County	52,087	26.9	67,450	26.5	29.5
Total Washoe County	193,623	100.0	254,667	100.0	31.5

Source: Bureau of the Census, 1980 and 1990

- *Economic Activity*

About 40 percent of the workforce in Washoe County is employed in the service sector of the economy. Of the estimated 57,850 workers in the service sector in 1990, more than 53 percent (30,825 workers) were employed in the hotel/gaming industry (Table 3.15-2).

Payrolls totaled nearly \$3.0 billion in 1989 (Nevada Employment Security Research Department, 1990a). Service industries, which include commercial gaming, accounted for nearly 36 percent of the county's total payroll in 1989. Trade and government contributed the next highest earnings to the area, representing 19.5 percent and 14.8 percent, respectively, in 1989. Per capita income in the county was \$20,920 in 1988, a 26 percent increase from 1985 (Bureau of Economic Analysis, 1990).

The rapidly expanding Nevada economy has facilitated growth in the Truckee Meadows. During 1990, the local economy exhibited signs of vitality, with growth moving along in the moderate range. Thousands of persons are moving to the area annually, new businesses are locating in northern Nevada, and employment gains are evident in all industrial sectors (Nevada Employment Security Research, 1990a).

3.15.2 *Delivery/Use Area*

- *Demographics*

The combined population of Lemmon and Spanish Springs Valleys in 1990 was 21,700 people (Washoe County, 1991a; 1991b). Projections by Washoe County indicate that this population is expected to increase to about 27,000 by 1995. By 2015, the population is expected to be 77,500, for a total increase of 50,500 people between 1995 and 2015.

- *Economic Activity*

There are two major industrial employers in Lemmon Valley; J.C. Penneys, Inc. and R.R. Donnelly, Inc. Several smaller manufacturing and warehousing operations are also in

TABLE 3.15-2

EMPLOYMENT BY SECTOR IN
WASHOE COUNTY: 1980 AND 1990

Sector	1980	Percent of Total	1990	Percent of Total
Mining	992	0.9%	1,508	1.0%
Construction	7,192	6.3	7,475	5.2
Manufacturing	8,100	7.1	8,775	6.1
Trans/Public Utilities	8,109	7.1	9,775	6.8
Fin/Ins/Real Estate	6,075	5.3	7,175	5.0
Trade	24,617	21.5	33,525	23.2
Service:				
Hotel/Gaming	28,608	25.0	30,825	21.3
Other	14,550	12.7	27,025	18.7
Government	16,142	14.1	18,350	12.7
TOTAL	114,385	100.0	144,433	100.0

Source: University of Nevada, 1991

Lemmon Valley. Other commercial activity is mainly in regional strip malls. Economic activity in Spanish Springs Valley is limited to a general convenience store and two aggregate pits used for construction materials. There is a large amount of agricultural land in the area and some rangeland that supports cattle. Many of the residents who live in Lemmon and Spanish Springs Valleys work in the Reno-Sparks metropolitan area, which is the primary employment center in Washoe County.

3.15.2 Water Source Area - Lassen and Washoe Counties

This section describes the socioeconomic conditions in the water source area, with particular emphasis on Honey Lake Valley.

• Demographics

There are ten homesites on the Nevada side of Honey Lake Valley (data provided by Washoe County Department of Comprehensive Planning). Most of the population is located west of Fish Springs Ranch.

The population on the California side of the water source area is dispersed among the communities of Doyle, Herlong, and Milford. The combined population of this area was 2,874 in 1980 (Lassen County, 1990). Outside of these three small communities, the water source area on the California side of Honey Lake Valley is sparsely populated.

Lassen County's total population was 27,598 in 1990 (Bureau of the Census, 1990). The county's population is projected to increase to 37,700 by the year 2000, for an average annual growth rate of about 3.7 percent (Lassen County, 1990). The county's only incorporated city, Susanville, had a 1990 population of 7,325 (Table 3.15-3).

- *Economic Activity*

The chief economic activities on the Nevada side of Honey Lake Valley are alfalfa production and livestock grazing. Cattle and sheep are grazed on public and private lands, whereas most grazing north of the valley is on public land (Section 3.14).

In Lassen County, government and services accounted for 63.4 percent of wage and salary employment in 1990, followed by wholesale and retail trade with 14.6 percent (Table 3.15-4). The United States Army (Sierra Army Depot) and the California Correctional Center are the largest employers in the county followed by the Lassen County School District (The Analytics Company, 1991). The Sierra Army Depot, located 10 miles west of Fish Springs Ranch, encompasses 96,000 acres. Its mission is the storage and disposal of ammunition. Total employment at the Sierra Army Depot in 1992 was 700 civilian and 350 military personnel (Rogers, 1992). The military personnel have on-base housing, whereas civilian employees commute from Susanville, Herlong, and Reno. The California Department of Corrections is constructing a major addition to their existing facilities in Lassen County.

Agriculture in Lassen County plays an important role in the local economy. Total value of agricultural production was \$42 million in 1989 and \$47 million in 1990 (Table 3.15-5). Livestock and livestock products, field crops, and nursery products (strawberry plants) have historically accounted for more than 95 percent of Lassen County's annual agricultural production. Livestock and livestock operations are located throughout the county, with 60 commercial livestock operations in Honey Lake Valley. The majority of Lassen County's alfalfa hay and strawberries are produced in Honey Lake Valley (Nader, 1991).

Geothermal resources have been developed on the California side of Honey Lake Valley. One geothermal electrical-generating plant operates near Wendel, California, about 30 miles northwest of Fish Springs Ranch.

TABLE 3.15-3				
POPULATION OF LASSEN COUNTY AND THE CITY OF SUSANVILLE: 1980 AND 1990				
Area	1980	Percent of Total	1990	Percent of Total
Susanville	6,520	30.1	7,325	26.5
Lassen County	15,141	69.9	20,273	73.5
Total	21,661	100.0	27,598	100.0
Source: Bureau of the Census, 1980 and 1990				

3.15.4 Pipeline Routes

• Demographics

Population along the proposed and alternative pipeline routes is limited to parts of Warm Springs Valley, Red Rock Valley, Antelope Valley and Hungry Valley. Table 3.15-6 provides current population estimates for Washoe County's Pyramid Lake and Warm Springs Valley Planning Areas; these two planning areas encompass all of the populated areas along the pipeline routes (Washoe County, 1991c; 1991d). The majority of the population in the Warm Springs Valley Planning Area is in and around the proposed gas pipeline route south of Highway 445. The majority of the population in the Pyramid Planning Area is in Red Rock Valley. Red Rock Estates forms the core of residential land use in Red Rock Valley (data from Washoe County Department of Comprehensive Planning). Less than 50 people live in Antelope Valley north of Lemmon Valley.

The Reno-Sparks Indian Colony is in Hungry Valley next to the route of the proposed water pipeline. About 330 people currently live in 98 houses at the Colony; plans exist to construct an additional 20 houses (Sam, 1992).

TABLE 3.15-4

EMPLOYMENT BY SECTOR FOR LASSEN COUNTY: 1987-1989

Sector	1987	1988	1989
Farm	718	759	764
Non-farm	9,045	9,293	9,577
Private:	5,375	5,575	5,799
Agricultural Services, Forestry, Fish, & Other	96	100	100
Mining	13	10	12
Construction	431	499	466
Manufacturing	765	800	909
Transportation & Public Utilities	358	348	366
Wholesale Trade	179	153	161
Retail Trade	1,474	1,503	1,512
Finance, Insurance & Retail Estate	367	417	422
Services	1,692	1,745	1,851
Government	3,670	3,178	3,778
Proprietors:	1,763	1,824	1,865
Farm	434	441	441
Non-farm	1,329	1,383	1,424

Source: Bureau of Economic Analysis, 1990

TABLE 3.15-5

AGRICULTURAL PRODUCTS AND LEADING COMMODITIES IN LASSEN COUNTY: 1989 AND 1990

Product	(In Millions of Dollars)	
	1989	1990
Livestock/Products	\$10.3	\$11.3
Field Crops	19.9	23.0
Vegetables	0.6	NA
Nursery Products	11.6	13.0
Seed Crops	0.4	NA
Total	42.4	47.3

Source: California Department of Finance, 1989 and 1990

- *Economic Activity*

Economic activity in the vicinity of the pipeline routes is limited largely to livestock grazing on public and private lands and alfalfa production. Industrial and commercial activity is non-existent. Aggregate pits have been developed in Red Rock Valley and Lemmon Valley.

According to current land use plans, most future development along either the proposed or alternative pipeline routes would probably be limited to low-density residential housing. Most area residents commute to the Reno-Sparks area for employment.

TABLE 3.15-6			
POPULATION FORECASTS FOR THE PYRAMID LAKE AND WARM SPRINGS PLANNING AREAS: 1990 AND 2007 ^(a)			
Planning Area	1990	2007	Net Increase
Pyramid Lake	265	400	135
Warm Springs	595	1,700	1,105
^(a) Population estimates beyond the year 2007 are not available for these areas. Source: Washoe County, 1991c; 1991d			

4.0 ENVIRONMENTAL CONSEQUENCES

• *Contents of Chapter 4*

This chapter analyzes and describes the direct, indirect, and cumulative impacts on the quality of the human environment from the proposed action and each alternative that was analyzed in detail, including the no action alternative. For the convenience of the reader, a fold-out map of the proposed and alternative pipeline routes is contained at the end of this document.

Direct impacts would occur from construction and operation of the pipelines and other facilities on public lands within the right-of-way corridors. Private lands would also be affected along the pipeline corridors, but these lands would not be included in rights-of-way granted by the BLM. Washoe County would negotiate with private land owners for access to these lands.

Compared to direct impacts, *indirect* impacts are farther removed in distance or would occur later in time. Because the rights-of-way would be used to export water from Honey Lake Valley, *indirect* impacts would accrue in Honey Lake Valley and nearby areas. Some impacts in Honey Lake Valley are estimated to occur over several hundred years, such as maximum land subsidence, and other impacts are described as far away as 30 miles from the proposed rights-of-way. Because the rights-of-way would be used to import water for planned growth in Lemmon and Spanish Springs Valleys, and this planned growth could result in environmental impacts, the rights-of-way would also have *indirect* impacts in Lemmon and Spanish Springs Valleys. Cumulative impacts could also occur throughout the Reno-Sparks metropolitan area from population growth if water supplies associated with the proposed action and its water-supply alternatives are developed.

This chapter also includes a discussion of mitigation of impacts, unavoidable adverse impacts, short-term use of the environment versus long-term productivity, and irreversible and irretrievable commitments of resources.

• *Analytical Framework and Assumptions*

The analyses of impacts along the proposed and alternative pipeline routes assume that a 15-foot-wide dirt maintenance road would remain within the 100-foot-wide rights-of-way after reclamation. In reality, Washoe County would only require roads within the rights-of-way where no roads now exist near, but outside, the rights-of-way. This assumption tends to slightly over-estimate the direct, long-term impacts from pipeline construction.

Washoe County plans to begin exporting groundwater from Honey Lake Valley in 1995 (see Chapter 2 for details). Demand in Lemmon and Spanish Springs Valleys for the entire 13,000 acre-ft/yr of Honey Lake Valley groundwater is not expected to occur until 2015. Hence, the *indirect* impacts from growth related to the proposed rights-of-way are evaluated for the year 2015. For comparison with the *Truckee Meadows Project*, water from both the supply side and negotiated settlement sub-alternatives is assumed to become available in

1995. Water from the negotiated settlement would accommodate forecasted growth in Lemmon and Spanish Springs Valleys through 2015, similar to the *Truckee Meadows Project*. Water from the supply side sub-alternative would meet forecasted growth only through the year 2000 in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows, after which it is assumed growth would cease. For comparison to the *Truckee Meadows Project* and to the negotiated settlement, growth impacts from the supply side sub-alternative are evaluated for the year 2015. The demand side sub-alternative, or conservation, would not add to existing water supplies. Impacts from this sub-alternative are therefore based solely on the implementation of reasonable measures to conserve water by future residents.

Water conservation requires a water supply from which to conserve. Conservation associated with development of both the supply side and negotiated settlement sub-alternatives could result in a water supply totaling 8,800 acre-feet by 2015. This water could support additional growth. The impacts of growth spurred by the conserved water are evaluated in the section on the *cumulative impacts* of developing the *Truckee Meadows Project* and its alternatives (Section 4.16). Cumulative impacts from the development of all these water sources are evaluated for the year 2032. The year 2032 was selected because it is the year that the total water supply from all sources evaluated in this EIS would be committed based on growth projections provided by Washoe County.

The time frame used to analyze impacts in the water source area is different than that used for Lemmon and Spanish Springs Valleys. Calculations indicate that 82 years would be required for the water table in Honey Lake Valley to stabilize at the new lower elevation projected in this EIS. The 82-year estimate is based on an *immediate* pumping rate of 13,000 acre-feet during the first year of the project and every year thereafter. Washoe County, however, would increase pumping gradually through a period of 20 years to meet an ultimate demand of 13,000 acre-ft/yr. By including these 20 years, the time required to reach steady-state conditions in the water source area is assumed to be 100 years.

On November 24, 1992, the Washoe County Commission amended its right-of-way applications to include several measures to eliminate adverse impacts to the endangered cui-ui and the threatened Lahontan cutthroat trout in Pyramid Lake (see Section 2.1.5 for details). Prior to the commencement of pumping, the county would acquire Truckee River water rights amounting to 547 acre-feet and dedicate them to Pyramid Lake. This water is intended to replace groundwater that computer modeling indicates would no longer reach Pyramid Lake due to Washoe County's planned groundwater pumping in Honey Lake Valley. Calculations also indicate that pumping in Honey Lake Valley could reduce the flow of groundwater to Pyramid Lake via the Smoke Creek Desert by 873 acre-ft/yr. Washoe County would avoid this projected impact by using one of the three methods described in Section 2.1.5. For purposes of analysis in this chapter, it is assumed that Washoe County would acquire a total of approximately 1,400 acre-feet of Truckee River water rights and dedicate them to Pyramid Lake. The location of the Truckee River water rights that would be acquired by the county and dedicated to the lake have not been specified.

Throughout Chapter 4, reference is made repeatedly to population growth in Lemmon Valley, Spanish Springs Valley, and in the Truckee Meadows, and the acreage of land disturbances associated with this growth. Table 4.15-1 estimates the population growth that

could be supported by the *Truckee Meadows Project* and each of the water-supply alternatives evaluated in this EIS. Table 4.14-1 estimates the acreage of land needed to support these various populations.

4.1 SOILS

4.1.1 Proposed Action

4.1.1.1 Direct Impacts

Minor short-term impacts are expected to soils from construction and operation of the proposed pipelines. A total of 940 acres of soils would be disturbed, of which 502 acres would be on public land. Some activities would occur during clearing of the rights-of-way, trench excavation, soil stockpiling, and from truck traffic on ungraded roads. Some mixing of soil horizons, along with decreased soil structure and increased soil compaction, would occur from the use of earth-moving equipment. These impacts would have a long-term, though minimal, impact on regional soil productivity. Increased wind erosion of disturbed surfaces would be expected for the first two to three years prior to re-establishment of some vegetative cover. Short-term water erosion on slopes greater than about 15 percent would be expected during heavy storms. No prime and unique farmland would be affected. Some irrigated hayland could be impacted in Warm Springs Valley.

Of the total 940 acres to be cleared for construction of the water and gas pipelines, 800 acres would be reclaimed. The remaining 140 acres of disturbed land would be required for an access and maintenance road, resulting in a long-term adverse impact to these soils.

Three acres would be cleared in Lemmon Valley for an access road leading to the water-storage tanks, and an additional two acres would be cleared and fenced for the tank site. Short-term wind erosion would occur until reclamation of these areas is completed. Long-term impacts would be negligible.

4.1.1.2 Indirect Impacts

• Water Source Area

Many of the fine-textured soils in eastern Honey Lake Valley have a surface crust up to one-quarter-inch thick, cemented by clay and soluble salts. Unless disturbed, these soils have little susceptibility to wind erosion. Moreover, the valley contains broad expanses of low, sparse vegetation that dissipate some of the wind energy that would otherwise disperse loose surface particles into the air.

Groundwater pumping at Fish Springs Ranch is projected to lower the water table over a broad area of eastern Honey Lake Valley. This, in turn, is projected to reduce the density and type of vegetation over an area of about 13,000 acres, particularly the phreatophytic vegetation. Soils in Honey Lake Valley could gradually become more exposed as this

vegetative cover is reduced. Subsequent wind erosion of these soils would increase (see Section 4.2 for emission estimates of particulate matter from this area). Soil erosion from water runoff would not be expected to increase appreciably due to the nearly level topography of Honey Lake Valley.

The playa next to Fish Springs Ranch is saline, meaning it contains excessive soluble salts, and is poorly drained. Drawdown of the water table is not expected to impact the playa's relatively low susceptibility to wind erosion.

About 1,400 acres of irrigated fields at Fish Springs Ranch would gradually be taken out of production as the rate of groundwater pumping increases at the well field. Some soil erosion and increased emissions of dust from these fields are likely, especially prior to succession by native vegetation and/or reclamation.

Existing soil contamination at the Sierra Army Depot would not be affected. The depth to groundwater at the Depot is far below any soil horizons due to long-term pumping by the Depot for its operations. Planned pumping at Fish Springs Ranch would have little affect on the Depot's groundwater and no affect on existing soil contamination.

Groundwater in the modeled portion of the Smoke Creek Desert is under *artesian* pressure. If this groundwater was not confined by overlying impermeable strata, it would rise above the land surface. The *artesian* elevation of the groundwater table in the modeled portion of the Smoke Creek Desert is projected to be lowered 28 feet by planned pumping at Fish Springs Ranch, but the *artesian* elevation of the water table would still be about nine feet above the land surface. The *actual depth* to the water table below the surface would remain unchanged. Hence, a reduction of *artesian* pressure would not be expected to affect the type or density of vegetation in the Smoke Creek Desert, and therefore the areal extent of soil exposure would be unaffected.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population. This growth would disturb soils over an estimated 200 acres in Lemmon Valley and 8,700 acres in Spanish Springs Valley. The acreage of irrigated soils in Spanish Spring Valley would probably be reduced due to residential development.

4.1.2 *Alternative Routes*

The indirect impacts that would occur to soils in the water source area and in Lemmon and Spanish Springs Valleys from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. Impacts in the water source area include increased wind erosion of areas where phreatophytic vegetation could be reduced, and wind erosion of the irrigated fields at Fish Springs Ranch as these fields

are taken out of production. Soils over an area of 8,900 acres would be disturbed for residential and commercial developments in Lemmon and Spanish Springs Valleys by 2015.

Refer to Table 2-6 for the acreage of disturbances associated with each of the alternative routes.

4.1.2.1 *Winnemucca Valley*

This alternative route would disturb 928 acres of soils, of which 357 acres would be on public land; 85 percent of the disturbed land would be reclaimed. Impacts to soils would occur during clearing of the rights-of-way, trench excavation, soil stockpiling, and truck traffic on ungraded roads. Some mixing of soil horizons, along with decreased soil structure and increased soil compaction, would occur from earth-moving equipment. These activities would have a long-term, though minimal, effect on regional soil productivity. Some increased wind erosion of disturbed surfaces would be expected prior to reclamation. Short-term water erosion of soils on slopes greater than about 15 percent would be expected during heavy storms. No prime and unique farmland would be affected. Some irrigated hayland could be impacted in Winnemucca Valley and Warm Springs Valley.

Three acres would be cleared in Lemmon Valley for an access road leading to the water-storage tanks, and an additional two acres would be cleared and fenced for the tank site. Short-term wind erosion would occur until reclamation of these areas is completed. Long-term impacts would be negligible.

4.1.2.2 *Antelope Valley*

This route would disturb 959 acres of soils, of which 435 acres would be on public land; 85 percent of the disturbed land would be reclaimed. Impacts to soils would occur during clearing of the rights-of-way, trench excavation, soil stockpiling, and truck traffic on ungraded roads. Mixing of soil horizons, along with decreased soil structure and increased soil compaction, would occur from earth-moving equipment. These activities would have a long-term, though minimal, effect on regional soil productivity. Some increased wind erosion of disturbed surfaces would be expected prior to reclamation. Short-term water erosion of soils on slopes greater than about 15 percent would be expected during heavy storms. No prime and unique farmland would be affected. Some irrigated hayland could be impacted in Warm Springs Valley.

Three acres would be cleared in Lemmon Valley for an access road leading to the water-storage tanks, and an additional two acres would be cleared and fenced for the tank site. Short-term wind erosion would occur until reclamation of these areas is completed. Long-term impacts would be negligible.

4.1.2.3 Red Rock Valley

This alternative route would disturb 1,179 acres of soils, of which 406 acres would be on public land; 85 percent of the disturbed land would be reclaimed. Impacts to soils would occur during clearing of the rights-of-way, trench excavation, soil stockpiling, and truck traffic on ungraded roads. Mixing of soil horizons, along with decreased soil structure and increased soil compaction, would occur from earth-moving equipment. These activities would have a long-term, though minimal, effect on regional soil productivity. Some increased wind erosion of disturbed surfaces would be expected prior to reclamation. Short-term water erosion of soils on slopes greater than about 15 percent would be expected during heavy storms. No prime and unique farmland would be affected. Some irrigated hayland could be impacted in Winnemucca Valley and Warm Springs Valley.

Three acres would be cleared in Lemmon Valley for an access road leading to the water-storage tanks, and an additional two acres would be cleared and fenced for the tank site. Short-term wind erosion would occur until reclamation of these areas is completed. Long-term impacts would be negligible.

4.1.3 No Action Alternative

Under no action, the rights-of-way would be denied. Continued irrigation at Fish Springs Ranch would not change the current use of the soils in the area. Alfalfa would continue to be grown at Fish Springs Ranch, which is a nitrogen-fixing plant. Some wind erosion of the soils in these fields commonly occurs during tillage operations in the spring and fall before and after planting. Although most fields and pastures are not planted annually, these fields still provide adequate ground cover to limit wind and water erosion.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.1.3.1 Supply Side Sub-Alternative

Additional groundwater pumping in the Truckee Meadows would have negligible impacts on soils in the affected area. The continued acquisition of Truckee River irrigation water rights would gradually reduce the acreage of irrigated lands in the Truckee Meadows. Short-term wind erosion and increased emissions of fugitive dust are likely from these fields, especially during their conversion to residential and commercial uses.

Under this sub-alternative, an additional 12,700 people would live in Lemmon and Spanish Springs Valleys by the year 2015. This growth would disturb soils over an estimated 100 acres in Lemmon Valley and 2,400 acres in Spanish Springs Valley. The acreage of irrigated soils in Spanish Springs Valley would probably be reduced due to residential development.

4.1.3.2 Demand Side Sub-Alternative

Aggressive conservation by future residents could reduce soil moisture and vegetative cover in the metropolitan area. This could increase the exposure of soils to erosion by wind and water.

4.1.3.3 Negotiated Settlement Sub-Alternative

Under this sub-alternative, an additional 46,500 people would live in Lemmon and Spanish Springs Valleys by the year 2015. This growth would disturb soils over an estimated 200 acres in Lemmon Valley and 8,700 acres in Spanish Springs Valley. An additional 92,800 people would be supported in the Truckee Meadows under this sub-alternative; 7,400 acres of soil would be disturbed for this growth. The acreage of irrigated soils in Spanish Spring Valley and in the Truckee Meadows would be reduced due to residential development.

4.2 AIR QUALITY

4.2.1 Proposed Action

4.2.1.1 Direct Impacts

- Routine Operations*

The quantity of air emissions released during routine operations would be small. Both the water and gas pipelines would be buried, and all disturbed areas would be reclaimed, with the exception of a 15-foot-wide dirt road required for access to the pipelines. During operation, the pipelines would be toured monthly with the use of a 4-wheel-drive vehicle for general inspection purposes. Wind erosion from this road, and fugitive emissions from the monthly inspection trip, would be negligible.

- Pipeline Construction*

The quantity of air emissions released during construction of the two pipelines would be greater compared to routine operations, but the emissions would be short-term. To determine the extent of construction impacts, an air emissions inventory for the pipeline routes was developed for the construction phase of the project, and an air quality model was used to predict impacts.

Emissions Inventory

During construction, there would be three sources of emissions: fugitive dust from construction, exhaust from construction vehicles and other equipment, and wind erosion from disturbed soil. A detailed emissions inventory for each of these three sources is contained in Appendix A.

Air Quality Impact Analysis

To determine the impact of these particulate emissions, they were input into EPA's Industrial Source Complex Short Term air quality dispersion model (EPA, 1987). The modeling also included wind erosion from the previous day's construction, even though PM₁₀ emissions from these sites are two orders of magnitude lower than PM₁₀ emissions from active construction sites.

The following conditions were used in the air dispersion modeling to determine maximum pollutant levels:

- 1) Steady winds blowing along the pipeline rights-of-way to maximize the impact of fugitive dust emissions to receptors (EPA, 1985a).
- 2) Construction was assumed to continue for 10 hours a day. During construction periods, site emissions were the sum of construction, exhaust, and wind erosion emissions. For the other 14 hours, the only site emissions were from wind erosion.
- 3) Receptors were defined in concentric rings in a polar grid system surrounding the site, with receptor distances varying between 164 feet and 5,250 feet.

With winds blowing steadily along the pipeline route, fugitive dust emissions caused 24-hour average particulate concentrations to exceed the air quality standard of 150 $\mu\text{g}/\text{m}^3$ for a distance of 1,312 feet along the pipeline route. Twenty-four-hour average particulate concentrations at distances of 2,625 feet and 5,250 feet are projected to be 60 and 22 $\mu\text{g}/\text{m}^3$, respectively. It is emphasized that these are maximum projected particulate concentrations, which would occur at any location for only one day, moving with pipeline construction. Except for the 330 people at the Reno-Sparks Indian Colony in Hungry Valley, the pipelines would be constructed in very sparsely populated areas. Most residences at the Reno-Sparks Indian Colony would be more than a half mile from the nearest construction zones.

An additional modeling run was conducted to determine the extent of the impact away from the pipeline. The modeling input parameters discussed above were unchanged except for the wind direction, which was rotated 90 degrees so that the wind was blowing perpendicular to the pipeline route rather than along the route. As expected, impacts were much lower; the standards for particulates were exceeded for only 394 feet from the pipeline route.

4.2.1.2 Indirect Impacts

- *Water Source Area*

Construction

Impacts to air quality from construction of the water-supply wells, installation of above-ground power lines, and construction of the main pumping station and related facilities are expected to be minor.

Well-Field Operations

Four natural gas-fired turbine generators would supply the electrical power needs of the project. Consumption of natural gas would increase through the year 2015 as the project's water-pumping requirements reach a maximum of 13,000 acre-ft/yr. Total emissions of nitrogen oxides from all four turbines in 2015 are estimated to be 42 tons/yr, well below the 250 tons/yr threshold for defining a major pollutant source. Because well-field operations would not be a major source of pollutants, the air quality impact is expected to be minimal.

Honey Lake Valley

Irrigation of 1,400 acres at Fish Springs Ranch would be terminated. Wind erosion of the soils in these fields would increase until other types of vegetation become established. The emissions of dust from these fields would be small and short-term.

The proposed rights-of-way could *indirectly* impact the air quality of eastern Honey Lake Valley because planned groundwater pumping at Fish Springs Ranch could eventually reduce phreatophytic vegetation in the valley. If this occurred, wind erosion and emissions of particulate matter could increase. As described in Section 4.6, black greasewood populations on 13,000 acres in eastern Honey Lake Valley could be reduced. This would cause a reduction in shrub cover. In areas where soil salinity is not too high, part of this black greasewood community could be re-colonized by non-phreatophytic shrubs from nearby shadscale vegetation communities. The balance of the affected area could change through plant succession to a cover of annual grasses and forbs.

For analytical purposes, a maximum theoretical increase in PM_{10} emissions was based on assuming a complete loss of greasewood over 13,000 acres (Appendix A). Results of the analysis indicated a maximum increase in 24-hour particulate concentrations of $14.4 \mu\text{g}/\text{m}^3$. Based on analogy to the Mono Lake Basin in California described in Chapter 3, exceedances of the 24-hour PM_{10} standard of $150 \mu\text{g}/\text{m}^3$ are probably rare in Honey Lake Valley, except during naturally-occurring drought conditions when parts of the bed of Honey Lake are exposed to strong winds. The theoretical maximum increase of $14.4 \mu\text{g}/\text{m}^3$ would exacerbate the 24-hour PM_{10} emission problems that probably exist in the valley under drought or very dry conditions. Annual average PM_{10} concentrations in Honey Lake Valley are probably in the range of 10 to $15 \mu\text{g}/\text{m}^3$, which is well below the annual average standard of $50 \mu\text{g}/\text{m}^3$. It is not likely that the projected increased emissions of PM_{10} from the potential reduction of greasewood vegetation would cause exceedances of the annual PM_{10} standard.

• Delivery/Use Area and the Truckee Meadows

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

These additional people would affect the air quality of both valleys from vehicle tailpipe emissions, re-suspension of road dust by moving vehicles, and wood burning. Many of these people would also travel to and from the Truckee Meadows for work, shopping, and recreation, thereby affecting the air quality of the Truckee Meadows.

Most of the Truckee Meadows is designated as nonattainment for two pollutants; particulates and carbon monoxide. All of Washoe County, which includes Lemmon and Spanish Springs Valleys, is designated as nonattainment for ozone. However, the Truckee Meadows is the source of most of the nitrogen oxides and hydrocarbons in the county which are the precursor emissions responsible for the current ozone problem.

An emission inventory for particulates, carbon monoxide, hydrocarbons, and nitrogen oxides was developed for the year 2015. The inventory focused on motor vehicles and residential wood burning, because they are the chief sources of these pollutants (see Section 3.2). Separate emissions inventories were developed for Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows, because substantial differences exist in growth projections and air quality problems in these areas.

Particulate Emissions Inventory

According to the most recent emissions inventory developed by Washoe County's Air Quality Management Division, fugitive dust sources account for approximately 83 percent of the total annual PM₁₀ emissions in the Truckee Meadows nonattainment area (Washoe County Air Quality Management Division, 1992). Furthermore, re-entrained road dust from motor vehicles travelling on paved streets is the largest single contributor to fugitive dust, estimated to account for 69 percent of the total annual PM₁₀ emissions inventory in 1990 (Washoe County Air Quality Management Division, 1992). The focus on PM₁₀ emissions is therefore on fugitive emissions from motor vehicles, both because this is the single largest source and because projected growth of vehicle travel on paved streets is expected to be the primary reason for the inability of the Truckee Meadows nonattainment area to meet PM₁₀ standards.

Motor Vehicles: Estimates of 1990 *vehicle miles travelled* (VMT) in the Truckee Meadows were developed by the Regional Transportation Commission (RTC, 1992). The commission also provided vehicle use estimates within the Truckee Meadows nonattainment area, Lemmon Valley, and Spanish Springs Valley for the proposed and alternative actions for the years 1995 and 2015 (Krause, 1993).

The U.S. Environmental Protection Agency has developed PM₁₀ emission factors for paved urban roads (EPA, 1985b). These emission factors vary depending on the roadway category such as local streets, collector and major streets, and freeways. The emission factors were applied to the projected VMT for each roadway category, as supplied by the Regional Transportation Commission.

Between 1995 and 2015, VMT is projected to increase by 61 percent in Lemmon Valley and by 483 percent in Spanish Springs Valley (Tables 4.2-1 and 4.2-2). The projected increase in vehicular travel would result in an 83 percent increase in PM₁₀ emissions in Lemmon

TABLE 4.2-1

**AIR EMISSIONS FROM MOBILE SOURCES
IN LEMMON VALLEY INDIRECTLY RELATED TO THE PROPOSED ACTION^(a)**

Category	Conditions in 1990	Conditions in 1995	Conditions in 2015	2015 Conditions Indirectly Related to Proposed Action
Population	18,200	19,444	27,618	2,900
Vehicle Miles Travelled (VMT)	387,300	459,400	739,900	77,700
PM ₁₀ Emissions, kg/day	694	820	1,500	160
Carbon Monoxide Emissions, kg/day	11,860	6,610	3,830	400
Hydrocarbon Emissions, kg/day	1,091	650	750	80
Nitrogen Oxides Emissions, kg/day	1,407	1,140	1,340	140

^(a) The proposed rights-of-way would accommodate some of the facilities that would provide water for population growth between 1995 and 2015. Note that only 2,900 of the 8,174 people forecasted to settle in Lemmon Valley between 1995 and 2015 would use water provided by the proposed pipeline. Estimates of VMT were provided by the Regional Transportation Commission of Washoe County on the basis of population forecasts for the years 1995 and 2015. Projected emissions of PM₁₀ are based on the VMT estimates and emission factors for paved urban roads (EPA, 1985b). Emissions of carbon monoxide, hydrocarbons, and nitrogen oxides are based on data in EPA (1985b).

Valley, of which only about 10 percent would be attributable to population growth supported in part by facilities in the proposed rights-of-way. The projected increase in VMT in Spanish Springs Valley would result in a 516 percent increase in PM₁₀ emissions, of which all would be attributable to population growth supported in part by facilities in the proposed rights-of-way. Note that the VMT in Spanish Springs Valley indirectly related to the proposed action in 2015 is greater than the difference in VMT between 1995 and 2015 because this valley is expected to develop shopping centers and office complexes that would attract people from the Truckee Meadows and elsewhere (Table 4.2-2). Although the projected increase in PM₁₀ emissions in Spanish Springs Valley by 2015 is very large, neither Spanish Springs Valley nor Lemmon Valley would be expected to exceed the 24-hour or annual average standards for PM₁₀.

Between 1995 and 2015, VMT is projected to increase by 53 percent in the Truckee Meadows nonattainment area (Table 4.2-3). This would result in a 50 percent increase in fugitive PM₁₀ emissions from motor vehicles. Although there would be no population growth in the Truckee Meadows from the proposed action, the 582,700 VMT in the

TABLE 4.2-2

**AIR EMISSIONS FROM MOBILE SOURCES
IN SPANISH SPRINGS VALLEY INDIRECTLY RELATED TO THE PROPOSED ACTION^(a)**

Category	Conditions in 1990	Conditions in 1995	Conditions in 2015	2015 Conditions Indirectly Related to Proposed Action
Population	3,500	6,260	49,870	43,600
Vehicle Miles Travelled (VMT)	58,540	149,000	869,300	760,000
PM ₁₀ Emissions, kg/day	214	580	3,540	3,100
Carbon Monoxide Emissions, kg/day	1,109	1,600	4,980	4,360
Hydrocarbon Emissions, kg/day	163	220	1,040	910
Nitrogen Oxides Emissions, kg/day	168	300	1,340	1,200

^(a) The proposed rights-of-way would accommodate some of the facilities that would provide water for population growth between 1995 and 2015. Estimates of VMT were provided by the Regional Transportation Commission of Washoe County on the basis of population forecasts for the years 1995 and 2015. Projected emissions of PM₁₀ are based on the VMT estimates and emission factors for paved urban roads (EPA, 1985b). Emissions of carbon monoxide, hydrocarbons, and nitrogen oxides are based on data in EPA (1985b).

nonattainment area shown on Table 4.2-3 would be from vehicle trips to the nonattainment area from Lemmon and Spanish Springs Valleys, as well as trips to Lemmon and Spanish Springs Valleys from the nonattainment area. Approximately 6.9 percent of the total PM₁₀ emissions in the year 2015, or 1,300 kg/day, would be indirectly related to the proposed action.

The Truckee Meadows is currently classified by the U.S. Environmental Protection Agency as a *moderate* nonattainment PM₁₀ area. Projected PM₁₀ inventories indicate a substantial increase in PM₁₀ emissions, and the Truckee Meadows is not expected to be in attainment with PM₁₀ standards by 1994 (Washoe County District Health Department, 1992a). Consequently, the Air Quality Management Division expects that the Truckee Meadows will be designated by the U.S. Environmental Protection Agency as a *serious* nonattainment area. This would require submission of a new State Implementation Plan and implementation of Best Available Control Measures for PM₁₀ sources. Projected increases in PM₁₀ emissions between 1995 and 2015 indirectly related to the proposed action would worsen an already existing attainment problem.

TABLE 4.2-3

AIR EMISSIONS FROM MOBILE SOURCES IN THE TRUCKEE MEADOWS NONATTAINMENT AREA INDIRECTLY RELATED TO THE PROPOSED ACTION^(a)

Category	Conditions in 1990	Conditions in 1995	Conditions in 2015	2015 Conditions Indirectly Related to Proposed Action
Population	201,700	215,490	296,970	0
Vehicle Miles Travelled (VMT)	3,818,200	4,700,500	7,188,700	582,700
PM ₁₀ Emissions, kg/day	10,100	12,700	18,900	1,300
Carbon Monoxide Emissions, kg/day	72,771	48,200	34,200	2,580
Hydrocarbon Emissions, kg/day	10,620	6,820	7,750	610
Nitrogen Oxides Emissions, kg/day	11,038	9,510	11,300	920

^(a) The proposed rights-of-way would accommodate some of the facilities that would provide water for population growth in Lemmon and Spanish Springs Valleys between 1995 and 2015. These people would contribute to air emissions in the Truckee Meadows Nonattainment Area from vehicle trips to the Truckee Meadows. Also, people would be attracted to Spanish Springs Valley from the Truckee Meadows which would contribute additional emissions to the Nonattainment Area. Estimates of VMT were provided by the Regional Transportation Commission of Washoe County on the basis of population forecasts for the years 1995 and 2015. Projected emissions of PM₁₀ are based on the VMT estimates and emission factors for paved urban roads (EPA, 1985b). Emissions of carbon monoxide, hydrocarbons, and nitrogen oxides are based on data in EPA (1985b).

Residential Wood Burning: Fireplaces and wood stoves are the other major sources of particulates in Washoe County. Since July of 1991, wood-burning devices have been prohibited in new residences in the Truckee Meadows, and their use is controlled by density requirements in outlying areas (Truckee Meadows Regional Planning Agency, 1991). Furthermore, the community (1) has established emission standards for wood-burning devices; (2) requires the replacement of non-certified wood-burning devices upon the sale of homes with these devices; and (3) maintains a *red, yellow, green* code for wood-burning devices during parts of the winter season when air quality problems are most prevalent in the Truckee Meadows. Because of these restrictions and programs, Washoe County's Air Quality Management Division estimates that particulate emissions from residential wood burning will decrease by three percent per year (Washoe County District Health Department, 1991).

Emissions Inventory Summary: The projected decrease in particulate emissions from residential wood-burning would partially offset the substantial increase in particulate

emissions from increasing vehicle use in the Truckee Meadows nonattainment area. Overall, the nonattainment area would experience a net increase in particulate emissions because re-entrained road dust from motor vehicles is the largest single contributor to fugitive dust, which in turn accounts for approximately 83 percent of the total annual PM₁₀ emissions in the nonattainment area (Washoe County District Health Department, 1992a).

Washoe County's Air Quality Management Division has made a commitment to full implementation of Reasonably Available Control Measures for the Truckee Meadows, which is currently classified as a *moderate* nonattainment PM₁₀ area. However, projected PM₁₀ inventories indicate a substantial increase in PM₁₀ emissions, and the Truckee Meadows will still not be in attainment with PM₁₀ standards by 1994 (Washoe County District Health Department, 1992a). Consequently, the area will probably be designated as a *serious* nonattainment area. This would require submission of a new State Implementation Plan and implementation of Best Available Control Measures for PM₁₀ sources. PM₁₀ emissions indirectly associated with the proposed action would contribute to the Truckee Meadows attainment problems for PM₁₀, particularly the 24-hour standard.

Carbon Monoxide Emissions Inventory

Motor Vehicles: Motor vehicles release carbon monoxide directly through tailpipe emissions. Emissions of carbon monoxide were determined by the use of two models run by the Washoe County Regional Transportation Commission, with technical support by the Air Quality Management Division. Vehicle use was calculated using the travel forecasting model, as already described. The vehicle use projections were then input into EPA's MOBILE4.1 model (EPA, 1985b).

Between 1995 and 2015, carbon monoxide emissions in Lemmon Valley are projected to *decrease* from 6,610 to 3,830 kg/day (Table 4.2-1). This decrease is expected largely from improvements in vehicle pollution-control technology.

Carbon monoxide emissions in Spanish Springs Valley between 1995 and 2015 would increase from 1,600 kg/day to 4,980 kg/day due to a substantial increase in the use of motor vehicles in the valley (Table 4.2-2). This increase is attributable entirely to population growth supported in part by facilities in the proposed rights-of-way. Spanish Springs Valley is outside the nonattainment area for carbon monoxide and these emissions would not be expected to affect attainment of carbon monoxide standards in the Truckee Meadows, which are likely to be achieved before 1995. Neither would these emissions affect the attainment status for carbon monoxide in Spanish Springs Valley by 2015.

Projected emissions of carbon monoxide in the Truckee Meadows nonattainment area would decrease from 48,200 kg/day in 1995 to 34,200 kg/day in 2015, even with the projected 53 percent increase in vehicle use during this period (Table 4.2-3). The reason for this decrease is expected improvements in vehicle pollution-control technology. Carbon monoxide emissions in the Truckee Meadows in 2015 associated with the proposed action are estimated to be 1,300 kg/day. This emission rate is unlikely to affect attainment of carbon monoxide standards in the Truckee Meadows, which are likely to be achieved before 1995.

Residential Wood Burning: Fireplaces and woodstoves are the other major sources of carbon monoxide in Washoe County. Because of restrictions in the use of fireplaces and wood stoves, the Air Quality Management Division has estimated that particulate emissions from residential wood burning would decrease by three percent per year (Washoe County District Health Department, 1991). It is assumed that carbon monoxide emissions from this source would also decrease by a similar amount.

Emissions Inventory Summary: The combined projected emissions of carbon monoxide in the Truckee Meadows, Lemmon Valley, and Spanish Springs Valley in 2015 is about 43,000 kg/day. This is 13,400 kg/day *less* than the 1995 emission estimates for the same area, even with the projected increase in vehicle use between 1995 and 2015, and 42,700 kg/day less than the 1990 carbon monoxide emissions. In addition, a moderate drop in carbon monoxide emissions from residential wood-burning is projected. The result is that the area should reach attainment of the carbon monoxide standard, even with full growth forecasted by Washoe County through 2015. Emissions of carbon monoxide from population growth supported in part by facilities in the proposed rights-of-way would not be expected to exceed federal and state standards for carbon monoxide.

Ozone Precursor Emissions Inventory - Hydrocarbons and Nitrogen Oxides

Control of ambient ozone concentrations has traditionally been implemented by controlling hydrocarbon emissions, particularly reactive organics. More recently, regulatory agencies have focussed on controlling emissions of nitrogen oxide in an effort to reduce ambient ozone concentrations. Therefore, an emissions inventory was developed for both hydrocarbons and nitrogen oxides.

Motor Vehicles: Motor vehicles release both hydrocarbons and nitrogen oxides directly through tailpipe emissions, and hydrocarbons through evaporative emissions as well. Emissions of these two pollutants were determined in a manner similar to that used to calculate carbon monoxide emissions: vehicle use was calculated using the Regional Transportation Commission's travel forecasting model, and emissions were determined using MOBILE4.1 (EPA, 1985b).

Emissions of hydrocarbons and nitrogen oxides in Lemmon Valley are projected to increase slightly between 1995 to 2015 (Table 4.2-1). This small increase is not expected to affect the attainment of ambient ozone air quality standards which should be achieved sometime between 1990 and 1995.

Emissions of hydrocarbons and nitrogen oxides from motor vehicles in Spanish Springs Valley are projected to increase substantially between 1995 and 2015, with all increases attributed to population growth supported in part by facilities in the proposed rights-of-way (Table 4.2-2). Hydrocarbon emissions are estimated to account for 11 percent of the total emissions in the nonattainment area by 2015. Emissions of nitrogen oxides are estimated to account for 10 percent of the total emissions in the nonattainment area by 2015. These emission rates would not be expected to affect the attainment of ambient ozone air quality standards which should be achieved sometime between 1990 and 1995.

Projected emissions of nitrogen oxides in the Truckee Meadows from mobile sources would increase from 9,510 kg/day in 1995 to 11,300 kg/day in 2015, of which about 51 percent would be indirectly related to the proposed action (Table 4.2-3). Projected emissions of hydrocarbons would increase from 6,820 kg/day in 1995 to 7,750 kg/day in 2015, of which the proposed action would indirectly account for about 66 percent. These emissions would not be expected to affect the attainment of ambient ozone air quality standards which should be achieved sometime between 1990 and 1995.

Emissions Inventory Summary: The reduction in hydrocarbon emissions from mobile sources from 1990 to 1995 is expected to result in attainment of the ozone standard in Washoe County. No violations of the ozone standard have been recorded during the past 36 months (Goodrich, 1993). The projected total increases in hydrocarbon emissions from 1995 to 2015 are not large enough to cause violations of the ozone standard. Hence, projected emissions associated with population growth supported in part by facilities in the proposed rights-of-way would not be expected to result in violations of the ozone standard.

4.2.1.3 Conclusions

Air quality impacts along the proposed pipeline routes would occur only during construction. Construction would cause fugitive dust emissions to exceed the 24-hour particulate standard. The impact would be localized and short-term. No impacts to people would be expected because the sparse population near the pipeline routes is not located within the small impact zone.

Increased emissions of particulate matter could occur in Honey Lake Valley from possible reductions in the black greasewood community over 13,000 acres. Analyses suggest a maximum increase in 24-hour particulate concentrations of $14.4 \mu\text{g}/\text{m}^3$. This would tend to exacerbate the 24-hour PM_{10} emission problems that probably exist in the valley under drought or very dry conditions. It is not likely that this projected increase in PM_{10} emissions would cause an exceedance of the annual average standard of $50 \mu\text{g}/\text{m}^3$.

Particulates, carbon monoxide, hydrocarbons, and nitrogen oxides are the pollutants of most concern in the Reno-Sparks metropolitan area. Air quality impacts in Lemmon Valley and Spanish Springs Valley are associated with the increased population that would be supported in part by facilities in the proposed rights-of-way. The analysis of emissions inventories for the entire metropolitan area for 1995, the year water deliveries would begin, and for 2015, the year that full water deliveries would begin, indicates that particulate emissions would increase substantially, carbon monoxide emissions would decrease, hydrocarbon emissions would increase, and nitrogen oxide emissions would increase.

These emissions, as well as that portion associated with growth supported in part by facilities in the proposed rights-of-way, would not be expected to affect the attainment of ambient ozone and carbon monoxide air-quality standards, which should be achieved sometime between 1990 and 1995. The Truckee Meadows is not expected to achieve compliance with the standards for PM_{10} by 1994. Consequently, the area's current designation as a *moderate* nonattainment area for PM_{10} will probably be changed to a *serious* nonattainment area. This

would require submission of a new State Implementation Plan and implementation of Best Available Control Measures for PM₁₀ sources. PM₁₀ emissions indirectly associated with the proposed action would contribute to the Truckee Meadows attainment problems for PM₁₀, particularly the 24-hour standard.

4.2.2 Alternative Routes

The air quality impacts from construction along the proposed pipeline routes were shown in Section 4.2.1.1 to be localized and short-term. Therefore, the only effect on air quality from selection of any of the alternative pipeline routes would be to change some of the locations where temporary air quality impacts on ambient particulate concentrations would occur.

4.2.3 No Action Alternative

Under the no action alternative, the rights-of-way would not be issued. Air quality impacts would not occur along either the proposed or alternative rights-of-way. Irrigation of 1,400 acres at Fish Springs Ranch would continue. Some wind erosion of the soils in these fields commonly occurs during tillage operations in the spring and fall before and after planting. Although most fields and pastures are not planted annually, they still provide adequate ground cover to limit wind erosion.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.2.3.1 Supply Side Sub-Alternative

The supply side sub-alternative would provide enough water for a population increase of 800 people in Lemmon Valley, 11,900 people in Spanish Springs Valley, and 22,700 people in the Truckee Meadows. Based on the estimated increase in population under this sub-alternative, projections were made of the VMT and emissions of PM₁₀, carbon monoxide, hydrocarbons, and nitrogen oxides for Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows.

Projected vehicle use and emissions in Lemmon and Spanish Springs Valleys under this sub-alternative indicate that attainment for particulates and carbon monoxide would be maintained, and attainment for ozone is expected in Washoe County long before 2015 (Tables 4.2-4 and 4.2-5). Consequently, no air quality problems would be expected under this sub-alternative in Lemmon and Spanish Springs Valleys.

Vehicle use and emissions in the Truckee Meadows under this sub-alternative are shown on Table 4.2-6. Attainment of carbon monoxide and ozone air-quality standards would be met

TABLE 4.2-4

**AIR EMISSIONS FROM MOBILE SOURCES IN LEMMON VALLEY ASSOCIATED WITH
ALTERNATIVES TO THE PROPOSED ACTION^(a)**

Category	Conditions in 2015 Associated with the Supply Side Sub-Alternative	Conditions in 2015 Associated with the Negotiated Settlement Sub- Alternative
Population	800	2,900
Vehicle Miles Travelled (VMT)	21,400	77,700
PM ₁₀ Emissions, kg/day	40	160
Carbon Monoxide Emissions, kg/day	110	400
Hydrocarbon Emissions, kg/day	20	80
Nitrogen Oxides Emissions, kg/day	40	140

^(a) Estimates of VMT were provided by the Regional Transportation Commission of Washoe County on the basis of population forecasts between the years 1995 and 2015. Projected emissions of PM₁₀ are based on the VMT estimates and emission factors for paved urban roads (EPA, 1985b). Emissions of carbon monoxide, hydrocarbons, and nitrogen oxides are based on data in EPA (1985b).

TABLE 4.2-5

**AIR EMISSIONS FROM MOBILE SOURCES IN SPANISH SPRINGS VALLEY ASSOCIATED WITH
ALTERNATIVES TO THE PROPOSED ACTION^(a)**

Category	Conditions in 2015 Associated with the Supply Side Sub- Alternative	Conditions in 2015 Associated with the Negotiated Settlement Sub-Alternative
Population	11,900	43,600
Vehicle Miles Travelled (VMT)	207,400	760,000
PM ₁₀ Emissions, kg/day	850	3,100
Carbon Monoxide Emissions, kg/day	1,190	4,360
Hydrocarbon Emissions, kg/day	240	910
Nitrogen Oxides Emissions, kg/day	330	1,200

^(a) Estimates of VMT were provided by the Regional Transportation Commission of Washoe County on the basis of population forecasts between the years 1995 and 2015. Projected emissions of PM₁₀ are based on the VMT estimates and emission factors for paved urban roads (EPA, 1985b). Emissions of carbon monoxide, hydrocarbons, and nitrogen oxides are based on data in EPA (1985b).

TABLE 4.2-6

AIR EMISSIONS FROM MOBILE SOURCES IN THE TRUCKEE MEADOWS NONATTAINMENT AREA ASSOCIATED WITH ALTERNATIVES TO THE PROPOSED ACTION^(a)

Category	Conditions in 2015 Associated with the Supply Side Sub-Alternative	Conditions in 2015 Associated with the Negotiated Settlement Sub-Alternative
Population	22,700	92,800
Vehicle Miles Travelled (VMT)	549,500	2,246,400
PM ₁₀ Emissions, kg/day	1,440	5,900
Carbon Monoxide Emissions, kg/day	2,620	10,700
Hydrocarbon Emissions, kg/day	590	2,420
Nitrogen Oxides Emissions, kg/day	870	3,540

^(a) Estimates of VMT were provided by the Regional Transportation Commission of Washoe County on the basis of population forecasts between the years 1995 and 2015. Projected emissions of PM₁₀ are based on the VMT estimates and emission factors for paved urban roads (EPA, 1985b). Emissions of carbon monoxide, hydrocarbons, and nitrogen oxides are based on data in EPA (1985b).

before 2015 because emissions of carbon monoxide would decline and emissions of nitrogen oxides and hydrocarbons would increase only slightly. The Truckee Meadows is not expected to achieve compliance with the standards for PM₁₀ by 1994. Consequently, the area's current designation as a *moderate* nonattainment area for PM₁₀ will probably be changed to a *serious* nonattainment area. This would require submission of a new State Implementation Plan and implementation of Best Available Control Measures for PM₁₀ sources. Population growth supported by the supply side sub-alternative would increase daily vehicle use in the Truckee Meadows in 2015 by 549,700 VMT. PM₁₀ emissions associated with this growth would contribute to the Truckee Meadows attainment problems for PM₁₀, particularly the 24-hour standard.

4.2.3.2 Demand Side Sub-Alternative

Under this sub-alternative, xeriscaping would become more prevalent throughout the Reno-Sparks metropolitan area. This could decrease soil moisture and increase wind erosion, thereby worsening the existing nonattainment status for PM₁₀ in the Truckee Meadows.

4.2.3.3 Negotiated Settlement Sub-Alternative

The negotiated settlement sub-alternative would provide enough water for a projected population increase between 1995 and 2015 of 2,900 people in Lemmon Valley, 43,600 people in Spanish Springs Valley, and 92,800 people in the Truckee Meadows. Based on the estimated increase in population under this sub-alternative, projections were made of

the VMT, and emissions of PM₁₀, carbon monoxide, hydrocarbons, and nitrogen oxides for Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows.

Projected vehicle use and emissions in Lemmon and Spanish Springs Valleys under this sub-alternative would be expected to maintain attainment for particulates and carbon monoxide, and attainment for ozone is expected in Washoe County long before 2015 (Tables 4.2-4 and 4.2-5). Consequently, no air quality problems would be expected under this sub-alternative in Lemmon and Spanish Springs Valleys.

Vehicle use and emissions in the Truckee Meadows under this sub-alternative are shown on Table 4.2-6. Attainment of carbon monoxide and ozone air-quality standards would be met before 2015 because emissions of carbon monoxide would decline and emissions of nitrogen oxides and hydrocarbons would increase only slightly. The Truckee Meadows is not expected to achieve compliance with the standards for PM₁₀ by 1994. Consequently, the area's current designation as a *moderate* nonattainment area for PM₁₀ will probably be changed to a *serious* nonattainment area. This would require submission of a new State Implementation Plan and implementation of Best Available Control Measures for PM₁₀ sources. Population growth supported by the negotiated settlement sub-alternative would increase daily vehicle use in the Truckee Meadows in 2015 by 2,246,400 VMT. PM₁₀ emissions associated with this growth would contribute to the Truckee Meadows attainment problems for PM₁₀, particularly the 24-hour standard.

4.3 SURFACE WATER

Refer to Figures 3.3-1 and 4.3-1 for the location of surface waters discussed in this section. Note also that there are two distinct drainages in the affected area called Cottonwood Creek. One is in Warm Springs Valley along and near the route of the proposed gas pipeline. The other is in Honey Lake Valley several miles east of Fish Springs Ranch.

4.3.1 Proposed Action

4.3.1.1 Direct Impacts

Temporary re-routing of eight perennial and intermittent streams would be required for construction of the water and gas pipelines. Included are crossings of Fish Springs Creek at the north end of the pipeline route and three crossings of Dry Valley Creek north of Bedell Flat. In southern Warm Springs Valley the gas pipeline would cross Cottonwood, Home Ranch, Wilcox, and Hay Creeks. Pipeline construction would increase sedimentation and erosion of stream beds which would continue to occur until restoration is completed. Fording of flowing streams by construction vehicles could also cause temporary increases in sedimentation. Accidental releases of hydraulic fluid, fuel, or oil into streams would adversely impact water quality. Standard operating procedures required during construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing potential impacts (see Section 2.1.6). Pipeline construction on private lands, as well as on public lands, would also require the

acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect stream environments. Long-term impacts to water quantity and quality would be negligible.

No springs would be directly impacted by construction of the water and gas pipelines. During construction, however, access to nearby springs along construction roads could increase vandalism and littering which could temporarily degrade water quality.

Pipeline construction in the 80 dry washes along the proposed water and gas pipeline routes could accelerate erosion and deposition during heavy storms. This could result in additional sediment loads downstream in the short term. Erosion, scouring, and increased sediment loading are expected to be minimal due to standard operating procedures and compliance with 404 permitting requirements through the U.S. Army Corps of Engineers (Section 2.1.6). Long-term impacts to the quantity and quality of waters that occasionally flow down these washes would be negligible.

At construction locations where subsurface water occurs, a temporary culvert across the pipeline trench would be installed to transport subsurface flow away from the trench. After installation of the pipeline, permanent piping across the trench, but below the surface, would be installed to maintain groundwater flow. Long-term impacts to water quantity and quality would be negligible.

Once every 10 to 15 years, segments of the water pipeline might be drained for inspection and maintenance (see Section 2.1.2.1). Eleven drain valves would be installed along the water pipeline at the locations shown on Figure 2-1. The quantity of water that could be discharged at each of the 11 locations is listed on Table 2-2. At all discharge locations, maximum downstream flow would be equivalent to a stream four inches deep and six feet wide (data from Washoe County). Water flow would be confined to existing washes. At each discharge point, the flow would decrease rapidly over several days as the water infiltrates into the ground. The volume of the flow at each discharge valve would have no measurable effects on the quantity or quality of surface waters.

On rare occasions, the water tanks in Lemmon Valley would be drained for repair or maintenance. As much as five million gallons of water, equivalent to about 15 acre-feet, would be discharged from the two water tanks via an overflow and drainage system (Figure 2-3). The water would flow to the playa in Lemmon Valley and slowly evaporate and infiltrate into the ground.

In summary, construction and operation of the water and gas pipelines would have no impact on the quantity of surface waters, and only minor, short-term impacts on the quality of surface waters.

4.3.1.2 Indirect Impacts

- *Water Source Area*

Water Quantity

The area of projected drawdown of the water table in relation to surface waters is shown on Figure 4.3-1. Figure 3.4-1 shows the groundwater elevation, flow direction, and depth to groundwater. In general, the springs in the mountains surrounding Honey Lake Valley are at elevations that are several hundred to several thousand feet above the regional groundwater system.

Honey Lake Valley: The springs along Cottonwood and East Cottonwood Creeks are within an area where drawdown of the water table is projected to be 21 to 78 feet. Well data suggest that these springs, which occur at and above elevations of 4,600 feet, are supplied by precipitation percolating through the rock, referred to as meteoric water, and perhaps by high-elevation aquifers. These springs are not connected to the regional groundwater system in Honey Lake Valley.

In April 1990, Washoe County had a test well drilled between Cottonwood and East Cottonwood Creeks. The elevation at the well site is 4,540 feet. The water elevation measured in the well was 4,307 feet, or 233 feet below the surface. On the basis of this information, the springs along and near Cottonwood and East Cottonwood Creeks are at least several hundred feet *above* the water table and are not in direct hydraulic connection with the regional groundwater system in Honey Lake Valley. Therefore, lowering the water table in the Cottonwood Creek area by as much as 78 feet would not be expected to adversely impact the quantity of water discharged at these springs.

In the foothills of the Virginia and Fort Sage Mountains, springs occur at elevations exceeding 4,600 feet and they, like the springs in the Cottonwood Creek area, are not connected to the regional groundwater system in Honey Lake Valley. In the Skedaddle Mountains north of Honey Lake Valley the water table is several thousand feet below the surface. Springs in this area would not be impacted by the projected 20 feet of drawdown.

Planned pumping at Fish Springs Ranch is projected to increase the flow of groundwater from the aquifers beneath Honey Lake toward eastern Honey Lake Valley by as much as 103 acre-ft/yr. All or part of this 103 acre-ft/yr may discharge to the lake. The potential reduction of 103 acre-ft/yr entering Honey Lake represents less than 0.08 percent of the lake's average annual budget of 130,000 acre-ft/yr from all water sources (Handman et al., 1990). This reduction in the lake's annual water budget would be insignificant to the maintenance of a stable shoreline considering that the lake fluctuates widely from season to season and has dried up more than a dozen times since 1859 (Rockwell, 1990; and recent observations).

The depth to groundwater at High Rock Spring is several feet below the surface. Planned pumping at Fish Springs Ranch is projected to lower the water table, and the pool elevation at the spring, by three to five feet.

Smoke Creek Desert: A 43 percent reduction in groundwater flow from Honey Lake Valley through Sand Pass to the Smoke Creek Desert could occur due to planned pumping at Fish Springs Ranch (Section 4.4). This could reduce the flow of springs and artesian wells in the southwestern Smoke Creek Desert. Data are unavailable on all the sources of groundwater recharge to this area, although total recharge to the entire Smoke Creek Desert is estimated at 16,000 acre-ft/yr (Glancy and Rush, 1968). A maximum reduction in the flow of these springs and wells would occur if groundwater from Honey Lake Valley was the *only* source of recharge. This would amount to 43 percent of the current flow from springs and wells at Bonham Ranch, Laird Springs, Buckbrush Springs, Rotten Egg Spring, Soda Springs, and other springs and wells in the area. Because it is likely that there are other sources of recharge to these springs and wells, actual flow reductions would probably be less than 43 percent, but the amount cannot be quantified with existing data.

Pyramid Lake: The proposed action would have no net effect on the quantity of water in Pyramid Lake. Projected reductions of groundwater flow to Pyramid Lake from Honey Lake Valley amount to about 1,400 acre-ft/yr (Section 4.4). This amount is about one-third of one percent of the average annual discharge of the Truckee River to Pyramid Lake. This minor reduction in groundwater flow to the lake would be offset by Washoe County's commitment to dedicate an identical amount of surface water from the Truckee River to Pyramid Lake.

Water Quality

Impacts to surface water quality after 100 years of pumping at Fish Springs Ranch would be relatively minor. Groundwater modeling described in Section 4.4 suggests little degradation would occur to the quality of surface waters in Honey Lake Valley or in surrounding areas.

Section 4.4 describes the projected changes in the concentration of total dissolved solids (TDS) in groundwater in Honey Lake Valley from planned pumping at Fish Springs Ranch. The water-quality model simulated the projected movement of TDS by the year 2088 based on the 1988 TDS distributions shown on Figure 3.4-3.

Section 4.4 describes the projected changes to groundwater quality throughout Honey Lake Valley; the reader is referred to that section for details. No impacts to groundwater quality, and hence to surface water quality, are projected in the Smoke Creek Desert, at Honey Lake, or at High Rock Spring in the northern part of Honey Lake Valley near the California-Nevada border. The projected water quality at the well field is described in Section 4.4. The following paragraphs describe the projected impacts to surface waters.

Pyramid Lake: The water quality of Pyramid Lake is affected primarily by inflows of surface water from the Truckee River. It is also affected by inflows of groundwater from adjoining basins, including Honey Lake Valley and the Smoke Creek Desert. It is projected that the groundwater inflow from Honey Lake Valley through Astor Pass to Pyramid Lake would be reduced by 547 acre-ft/yr or 35 percent of current groundwater inflows through the pass. Due to pumping at Fish Springs Ranch, the TDS of the remaining groundwater that flows through the pass would increase by 1.6 percent. The net effect on the water quality of

Pyramid Lake from a 35 percent decrease in the amount of groundwater entering the lake from this area, along with a 1.6 percent increase in the TDS concentrations, would be an annual reduction of 1,300 tons of TDS mass entering the lake.

Groundwater also flows from Honey Lake Valley to Pyramid Lake via Sand Pass-Smoke Creek Desert-Terraced Hills, thereby affecting the water quality of the lake. TDS levels in groundwater in the modeled portions of the Smoke Creek Desert are high, ranging from 1,000 to 2,000 ppm. It is likely that the TDS concentration of groundwater entering Pyramid Lake from the Smoke Creek Desert is also high, and that the projected reduction in groundwater flow from the Smoke Creek Desert to Pyramid Lake would also reduce the mass of TDS entering the lake.

The applicant's commitment to replace the projected reductions in groundwater flow to Pyramid Lake with Truckee River water would improve the lake's water quality by a negligible amount. About 1,400 acre-ft/yr of relatively poor-quality groundwater that now enters the lake would be replaced with better-quality water from the Truckee River. TDS concentrations in the Truckee River near Nixon, Nevada, just prior to entering the lake, generally range from 200 ppm during high-flow years to 600 ppm during drought years (Washoe County, 1992). Although any improvement in the quality of water at Pyramid Lake would be beneficial, the projected improvement from the proposed action would be insignificant because 1,400 acre-ft/yr amounts to only one-third of one percent of the average annual discharge to the lake from the Truckee River.

Springs that Discharge in the Mountains: TDS concentrations in groundwater are projected to increase by 10 ppm in the Virginia Mountains east of the pumping station. This increase is not expected to affect the springs and creeks that discharge in the Virginia Mountains. This conclusion is based on the altitude of these surface waters which are several hundred feet higher than the regional groundwater system that would be affected by pumping at Fish Springs Ranch. The water supply for these springs is probably a combination of meteoric and semi-perched water. No other adverse impacts are projected to occur.

Sierra Army Depot: The Sierra Army Depot pumps several wells for their supplies of drinking water. Although the model indicates a maximum groundwater-migration distance at the Depot of only 37 feet after 100 years, the potential exists that poor-quality groundwater west of the Depot could travel eastward towards the Depot's potable water supplies. See Section 4.4 for details.

- ***Delivery/Use Area***

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

All the delivered water would remain in those valleys. At full delivery 20 years after start up, this would amount to an additional 800 acre-ft/yr of water in Lemmon Valley and 12,200 acre-ft/yr of water in Spanish Springs Valley.

Lemmon Valley

Of the 800 acre-ft/yr of water to be delivered to Lemmon Valley, an estimated 50 percent would be used consumptively from evapotranspiration by lawns and other plants (Moser, 1992). The remaining 400 acre-ft/yr would be treated in one or both of the existing wastewater treatment facilities in Lemmon Valley. The Lemmon Valley wastewater treatment facility has a remaining capacity to support about 660 new people; the Reno-Stead wastewater treatment facility could support an additional 5,750 people. Therefore, the combined wastewater-treatment capacity currently remaining at these two treatment facilities is sufficient for the 2,900 new people that would be supported in part by facilities in the proposed rights-of-way.

The final disposal method for the treated wastewater is not known at this time. It could be discharged directly to Lemmon playa where an estimated 50 percent (200 acre-ft/yr) would remain at the surface and slowly evaporate. The other 200 acre-ft/yr would recharge the groundwater system beneath the playa. The quality of the discharged wastewater would not be allowed to degrade the quality of the receiving waters because discharges could not exceed water quality standards established by the State of Nevada. Appropriate discharge standards would be identified by the State of Nevada during acquisition of a *discharge permit*. Other disposal options for the treated wastewater include irrigation of recreation facilities such as golf courses and baseball fields, and the maintenance and enhancement of wetlands in the valley.

Spanish Springs Valley

By 2015, 12,200 acre-ft/yr of groundwater from Honey Lake Valley would be delivered to Spanish Springs Valley. The specific wastewater treatment and disposal facilities have not been identified at this time. A variety of wastewater disposal methods are available including irrigation of recreation facilities and open space, wetlands enhancement, and recharge basins. In the event that wastewater is treated and disposed of through recharge basins in Spanish Springs Valley, 3,000 acre-ft/yr could recharge the aquifers in the valley. Depending on the location of these recharge basins, this infiltration could increase groundwater flows from Spanish Springs Valley to the Truckee Meadows. Data are not available to quantify potential impacts to surface waters in the Truckee Meadows. The U.S. Geological Survey is currently investigating groundwater conditions in Spanish Springs Valley. The quality of the discharged water would not be allowed to degrade the quality of the receiving groundwater because discharges would be subject to Nevada State regulations.

4.3.1.3 Conclusions

Construction and operation of the pipelines along the proposed rights-of-way would have no direct impact on the availability of surface waters, and only minor, short-term impacts on the quality of surface waters.

Indirect, minor beneficial impacts to surface water quality would occur from planned groundwater pumping at Fish Springs Ranch. The chief effect would be a negligible reduction in the amount of TDS entering Pyramid Lake. The water quality of springs and wells in Honey Lake Valley, the Smoke Creek Desert, and in the surrounding mountains would be unaffected.

The projected reduction of groundwater flow to the Pyramid Lake Basin of 1,400 acre-ft/yr would be replaced with equal amounts of acquired Truckee River water by Washoe County. This water would then be dedicated to Pyramid Lake.

The flow of springs and artesian wells in the southwestern southern Smoke Creek Desert could be reduced by as much as 43 percent. Other springs and wells in the water source area would be largely unaffected.

Impacts to the quality of surface waters in Lemmon and Spanish Springs Valleys from wastewater discharges would be negligible. The treated wastewater would be available to both valleys for a variety of uses.

4.3.2 Alternative Routes

Indirect impacts to surface waters in the water source area and in Lemmon and Spanish Springs Valleys from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. To summarize, impacts in the water source area include a minor reduction in the amount of TDS entering Pyramid Lake and a reduction in the flow of springs and artesian wells in the southwestern Smoke Creek Desert.

Between 1995 and 2015, an additional 46,500 people could be supported in Lemmon and Spanish Springs Valleys using water from Honey Lake Valley. Impacts to the quality of surface waters in these valleys from wastewater discharges would be negligible. The treated wastewater would be available to both valleys for a variety of purposes. The final disposal method for the treated wastewater, and the location of treatment facilities in Spanish Springs Valley, are not known at this time.

Each alternative water pipeline would contain drain valves, similar to the proposed pipeline. Although the locations of drain valves along the alternative routes have not been identified, impacts would be expected to be negligible, similar to those described under the proposed route.

Refer to Section 4.3.1.1 for a description of the engineering practices that would be used to cross streams and dry washes.

4.3.2.1 *Winnemucca Valley*

The Winnemucca Valley route would avoid Bedell Flat. It would pass within a few hundred feet of two springs in Winnemucca Valley, a cluster of springs at the north end of Warm Springs Valley, and one spring at Newcombe Lake (dry) in the Virginia Mountains. Although not within the right-of-way, impacts to the water quality and aesthetic appeal of these springs could occur from vandalism and littering associated with increased human presence in these areas during pipeline construction.

Temporary re-routing of seven perennial and intermittent creeks would be required during construction of both the water and gas pipelines. Fish Springs Creek and two forks of upper Dry Valley Creek would be crossed by the water and gas pipelines. In addition, the gas pipeline in Warm Springs Valley would cross Cottonwood, Home Ranch, Wilcox, and Hay Creeks. Pipeline construction would increase sedimentation and erosion of stream beds which would continue to occur until restoration is completed. Fording of flowing streams by construction vehicles could cause temporary increases in sedimentation. Accidental release of hydraulic fluid, fuel, or oil into streams would adversely impact water quality. Standard operating procedures required during construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing these impacts (see Section 2.1.6). Pipeline construction on private lands, as well as public lands, would also require the acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect stream environments. Long-term impacts to water quantity and quality would be expected to be negligible.

Pipeline construction in the 66 dry washes along this alternative route could accelerate erosion and deposition during heavy storms. This could result in additional sediment loads downstream in the short term. Erosion, scouring, and increased sediment loading are expected to be minimal due to standard operating procedures and compliance with 404 permitting requirements through the U.S. Army Corps of Engineers (Section 2.1.6). Long-term impacts to the quantity and quality of waters that occasionally flow down these washes would be negligible.

In summary, impacts to surface waters from pipeline construction and operation along the Winnemucca Valley route would be short-term and minor.

4.3.2.2 *Antelope Valley*

The water pipeline would pass just west of a small playa in Antelope Valley. Impacts to the quality and quantity of waters that occasionally fill the playa, as well as impacts to the hydrologic setting of the playa, would not be expected.

Temporary re-routing of eight perennial and intermittent creeks would be required during construction of both the water and gas pipelines. These include crossings at Fish Springs Creek at the northern end of the pipelines and three crossings of Dry Valley Creek north of Bedell Flat. In addition, the gas pipeline in southern Warm Springs Valley would cross Cottonwood, Home Ranch, Wilcox, and Hay Creeks. Pipeline construction would increase sedimentation and erosion of stream beds which would continue to occur until restoration is completed. Fording of flowing streams by construction vehicles could cause temporary increases in sedimentation. Accidental release of hydraulic fluid or oil into streams would adversely impact water quality. Standard operating procedures required during construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing these impacts (see Section 2.1.6). Pipeline construction on private lands, as well as public lands, would also require the acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers' pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect stream environments. Long-term impacts to water quantity and quality would be expected to be negligible.

Pipeline construction in the 80 dry washes along this alternative route could accelerate erosion and deposition during heavy storms. This could result in additional sediment loads downstream in the short term. Erosion, scouring, and increased sediment loading are expected to be minimal due to standard operating procedures and compliance with 404 permitting requirements through the U.S. Army Corps of Engineers (Section 2.1.6). Long-term impacts to the quantity and quality of waters that occasionally flow down these washes would be negligible.

In summary, impacts to surface waters from pipeline construction and operation along the Antelope Valley route would be short-term and minor.

4.3.2.3 Red Rock Valley

The Red Rock Valley route would avoid Bedell Flat. The gas pipeline would pass within a few hundred feet of two springs in Winnemucca Valley, a cluster of springs at the north end of Warm Springs Valley, and one spring at Newcombe Lake (dry) in the Virginia Mountains. Although not within the rights-of-way, impacts to the water quality and aesthetic appeal of these springs could occur from vandalism and littering associated with increased human presence in these areas during pipeline construction.

Temporary re-routing of eight perennial and intermittent creeks would be required during construction of both the water and gas pipelines. These include crossings at Fish Springs Creek at the northern end of the pipelines and three crossings of Dry Valley Creek north of Bedell Flat. The gas pipeline in southern Warm Springs Valley would cross Cottonwood, Home Ranch, Wilcox, and Hay Creeks. A short, perennial stream, wetlands, and standing bodies of water in southern Red Rock Valley would be near the construction right-of-way for the water pipeline. Pipeline construction would increase sedimentation and erosion of stream beds which would continue to occur until restoration is completed. Fording of flowing streams by construction vehicles could cause temporary increases in sedimentation.

Accidental release of hydraulic fluid, fuel, or oil into streams would adversely impact water quality. Standard operating procedures required during construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing these impacts (see Section 2.1.6). Pipeline construction on private lands, as well as public lands, would also require the acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers' pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect stream environments. With the exception of Red Rock Valley, long-term impacts to the quantity and quality of surface water from pipeline construction along this route would be expected to be negligible.

In southern Red Rock Valley, some dredge and fill of wetlands would probably be needed, thereby requiring a 404 Permit from the U.S. Army Corps of Engineers pursuant to the Clean Water Act. Although the pipeline would be constructed within or along the road bed in this area, the quality of these surface waters could nevertheless be adversely impacted from such things as sediment loading and fuel and lubricant leaks. Many years would probably be required for the water quality to recover.

Pipeline construction in the 89 dry washes along this alternative route could accelerate erosion and deposition during heavy storms. This could result in additional sediment loads downstream in the short term. Erosion, scouring, and increased sediment loading are expected to be minimal due to standard operating procedures and compliance with 404 permitting requirements through the U.S. Army Corps of Engineers (Section 2.1.6). Long-term impacts to the quantity and quality of waters that occasionally flow down these washes would be negligible.

In summary, impacts to surface-water quality and quantity from pipeline construction and operation along the Red Rock Valley would be significant in southern Red Rock Valley. Elsewhere, impacts to surface waters would be short-term and minor.

4.3.3 *No Action Alternative*

Under the no action alternative, the rights-of-way would be denied. No impacts to surface waters would occur along the pipeline routes. Fish Springs Ranch would continue to pump approximately 5,910 acre-ft/yr for irrigation. The owners of Fish Springs Ranch would retain the rights to approximately 14,000 acre-ft of water, some portion of which would presumably be put to beneficial use. The quality and quantity of surface waters in the water source area would be unaffected.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.3.3.1 *Supply Side Sub-Alternative*

This sub-alternative includes the acquisition of 6,900 acre-ft/yr of Truckee River irrigation rights and their conversion to municipal and industrial uses. Many of these irrigation rights are inactive; they flow to downstream water users and to Pyramid Lake. Their conversion to municipal and industrial uses would reduce the flow of the Truckee River because part of this water would be used consumptively and not returned to the river. Conversion of active rights to municipal and industrial uses would tend to increase urban runoff in the Truckee Meadows with associated adverse impacts to the Truckee River. As irrigated lands are converted to residential and commercial uses, agricultural return flows to the Truckee River, and their high levels of nitrates and phosphates, would be reduced, thereby benefiting the water quality of the river (EPA, 1984).

Approximately 3,000 acre-ft/yr of groundwater would also be available to the Reno-Sparks metropolitan area under this sub-alternative. The availability of this water would be subject to approval by the State Engineer. Impacts to surface waters from this groundwater pumping cannot be assessed because the locations of the four new wells associated with this sub-alternative are not known.

- *Lemmon and Spanish Springs Valleys*

Under this sub-alternative, 223 acre-ft/yr of water would be delivered to Lemmon Valley and 3,320 acre-ft/yr would be delivered to Spanish Springs Valley. An estimated 50 percent of each supply would be used consumptively from evapotranspiration by lawns and other plants (Moser, 1992). The remaining 50 percent, equivalent to 112 acre-ft/yr for Lemmon Valley and 1,660 acre-ft/yr for Spanish Springs Valley, would be treated and disposed of either through treatment plants in those valleys or sewerage back to the Truckee River via the Truckee Meadows Water Reclamation Facility.

The final disposal method of the treated wastewater in each valley is not known at this time. In Lemmon Valley, the water could be discharged directly to Lemmon playa where about 50 percent (56 acre-ft/yr) would remain at the surface and slowly evaporate. The other 56 acre-ft/yr would recharge the groundwater system beneath the playa. The Lemmon Valley wastewater treatment facility has a remaining capacity to support about 660 new people; the Reno-Stead wastewater treatment facility could support an additional 5,750 people. Therefore, the combined wastewater-treatment capacity currently remaining at these two treatment facilities is sufficient to support the 800 new people that would be supported by this sub-alternative in Lemmon Valley.

Discharge of treated wastewater to recharge basins in Spanish Springs Valleys would result in evaporation of approximately 830 acre-ft/yr of standing water. Depending on the location of these basins, this infiltration could increase groundwater flows from Spanish Springs Valley to the Truckee Meadows. Data are not available to quantify potential impacts to surface waters in the Truckee Meadows. The U.S. Geological Survey is currently investigating groundwater conditions in Spanish Springs Valley. The quality of the discharged water would not be allowed to degrade the quality of the receiving groundwater because discharges would be subject to Nevada State regulations.

Other disposal options in both valleys could include irrigation of recreation facilities such as golf courses and baseball fields and maintenance and enhancement of wetlands.

Truckee Meadows

By the year 2015, this sub-alternative would support an additional 22,700 people in the Truckee Meadows. These people would cause an increase in urban runoff to the Truckee River from sources such as industrial wastes, hydrocarbons, and construction materials. The conversion of inactive irrigation rights to municipal and industrial uses would reduce the flow of the Truckee River because part of this water would be used consumptively and not returned to the river. Conversion of active rights to municipal and industrial use would tend to increase urban runoff in the Truckee Meadows with associated adverse impacts to the Truckee River. As irrigated lands are converted to residential and commercial uses, agricultural return flows to the Truckee River, and their high levels of nitrates and phosphates, would be reduced, thereby improving the water quality of the river (EPA, 1984).

This sub-alternative would supply 6,333 acre-ft/yr of water to the Truckee Meadows. Approximately half of this supply, or 3,167 acre-ft/yr, would be wastewater that would be treated and disposed. Disposal could be through a variety of methods. Some wastewater could pass through the Truckee Meadows Water Reclamation Facility and be discharged to the Truckee River. Alternatively, wastewater could be disposed of via the South Truckee Meadows Wastewater Treatment Plant or some other method of wastewater disposal. The quality of the discharged wastewater would not be allowed to degrade the quality of the receiving waters because the discharges could not exceed water quality standards established by the State of Nevada. Appropriate discharge standards would be identified by the State of Nevada during acquisition of a *discharge permit*.

4.3.3.2 Demand Side Sub-Alternative

Water conservation in the Reno-Sparks metropolitan area would minimize the use of Truckee River water. This would benefit the Truckee River and Pyramid Lake by minimizing the amount of wastewater that is treated and released to the river. Outside water conservation would reduce the amount of runoff in the metropolitan area, which could reduce urban runoff to the Truckee River. In general, water conservation would decrease consumptive losses to evapotranspiration, thereby increasing the volume of water that would be available for other uses.

4.3.3.3 Negotiated Settlement Sub-Alternative

Section 204 of the Negotiated Settlement Act provides a framework for the allocation of the waters of the Truckee River. Section 205 of the Act requires the negotiation of an agreement between the States of Nevada and California for operation of the reservoirs on the Truckee River to enhance spawning flows for threatened and endangered fish. This operating agreement is subject to the National Environmental Policy Act and an EIS is

currently being prepared by the U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation for release in the mid-1990s.

On the basis of the intent of the negotiated settlement, impacts to surface waters such as the Truckee River and Pyramid Lake are expected to be beneficial. Section 25 of the *Preliminary Settlement Agreement* between the Pyramid Lake Paiute Tribe and Westpac Utilities allows for the export of Truckee River water to other basins providing that additional water rights are acquired in order to insure that return flows to the Truckee River are not less than they would be if the water had been used in the Truckee River Basin.

Lemmon and Spanish Springs Valleys

Between 1995 and 2015, an additional 46,500 people would live in Lemmon and Spanish Springs Valleys using water from the negotiated settlement. Of the 800 acre-ft/yr delivered to Lemmon Valley and the 12,200 acre-ft/yr delivered to Spanish Springs Valley, an estimated 50 percent of each supply would be used consumptively from evapotranspiration by lawns and other plants (Moser, 1992). The remaining 50 percent, equivalent to 400 acre-ft/yr for Lemmon Valley and 6,100 acre-ft/yr for Spanish Springs Valley, would be either treated and disposed of through treatment plants in those valleys or sewer back to the Truckee River via the Truckee Meadows Water Reclamation Facility.

Final disposal of the treated wastewater in each valley is not known at this time. In Lemmon Valley, the water could be discharged directly to Lemmon playa where an estimated 50 percent (200 acre-ft/yr) would remain at the surface and slowly evaporate; the other 200 acre-ft/yr would recharge the groundwater system beneath the playa. The Lemmon Valley wastewater treatment facility has a remaining capacity to support about 660 new people; the Reno-Stead wastewater treatment facility could support an additional 5,750 people. Therefore, the combined wastewater-treatment capacity currently remaining at these two treatment facilities is sufficient to support the 2,900 new people that would be supported by this sub-alternative in Lemmon Valley.

Discharge of treated wastewater to recharge basins in Spanish Springs Valleys would result in evaporation of approximately 830 acre-ft/yr of standing water. Depending on the location of the basins, this infiltration could increase groundwater flows from Spanish Springs Valley to the Truckee Meadows. Data are not available to quantify potential impacts to surface waters in the Truckee Meadows. The U.S. Geological Survey is currently investigating groundwater conditions in Spanish Springs Valley. The quality of the discharged water would not be allowed to degrade the quality of the receiving groundwater because discharges would be subject to Nevada State regulations.

The treated wastewater in these valleys could also be used for irrigation of recreation facilities such as golf courses and baseball fields or used to maintain and enhance wetlands.

Truckee Meadows

By the year 2015, this sub-alternative would support an additional 92,800 people in the Truckee Meadows. These additional people would cause an increase in urban runoff to the Truckee River. This includes sources such as industrial wastes, hydrocarbons, and construction materials. The conversion of inactive irrigation rights to municipal and industrial uses would reduce the flow of the Truckee River because part of this water would be used consumptively and not returned to the river. Conversion of active rights to municipal and industrial use would tend to increase urban runoff in the Truckee Meadows with associated adverse impacts to the Truckee River. As irrigated lands are converted to residential and commercial uses, agricultural return flows to the Truckee River, and their high levels of nitrates and phosphates, would be reduced, thereby improving the water quality of the river (EPA, 1984).

This sub-alternative would supply 25,890 acre-ft/yr of water to the Truckee Meadows. Approximately half of this supply, or 12,950 acre-ft/yr, would be wastewater that would be treated and disposed of through a variety of methods. Some wastewater could pass through the Truckee Meadows Water Reclamation Facility and discharged to the Truckee River. Alternatively, wastewater could be disposed of via the South Truckee Meadows Wastewater Treatment Plant or some other method of wastewater disposal. The quality of the discharged wastewater could not exceed water quality standards established by the State of Nevada. Appropriate discharge standards would be identified by the State of Nevada during acquisition of a *discharge permit*.

4.4 GROUNDWATER

4.4.1 Proposed Action

4.4.1.1 Direct Impacts

No impacts to groundwater are expected during installation of the water and gas pipelines. The pipelines would be buried to a minimum depth of three feet below the surface and a maximum depth at stream crossings of about 12 feet. Impacts to areas of shallow groundwater would be temporary and groundwater levels would be expected to return to pre-pipeline conditions shortly after installation.

4.4.1.2 Indirect Impacts

- *Water Source Area*

The impacts to groundwater quantity and quality discussed in this section are based on computer modeling. Parts of these models rely on limited data, average and estimated conditions, and many assumptions. A model is an approximation of the actual groundwater system, but it is not able to precisely duplicate real conditions. A limitation of the water flow model used for this EIS is that it is calibrated to conditions that are assumed to be

steady state. Calibration of a transient model, where conditions change over time, requires a record of these changes. Long-term historical data in the model area were insufficient to establish a transient model. Because of these and other uncertainties, the modeling results should not be assumed to be completely accurate. These models are simply tools that provide an indication of the magnitude of expected changes compared to current conditions. Nevertheless, the models used in this EIS are widely accepted in the scientific community and the modelling results are based on the best available data.

Groundwater Flow and Quantity

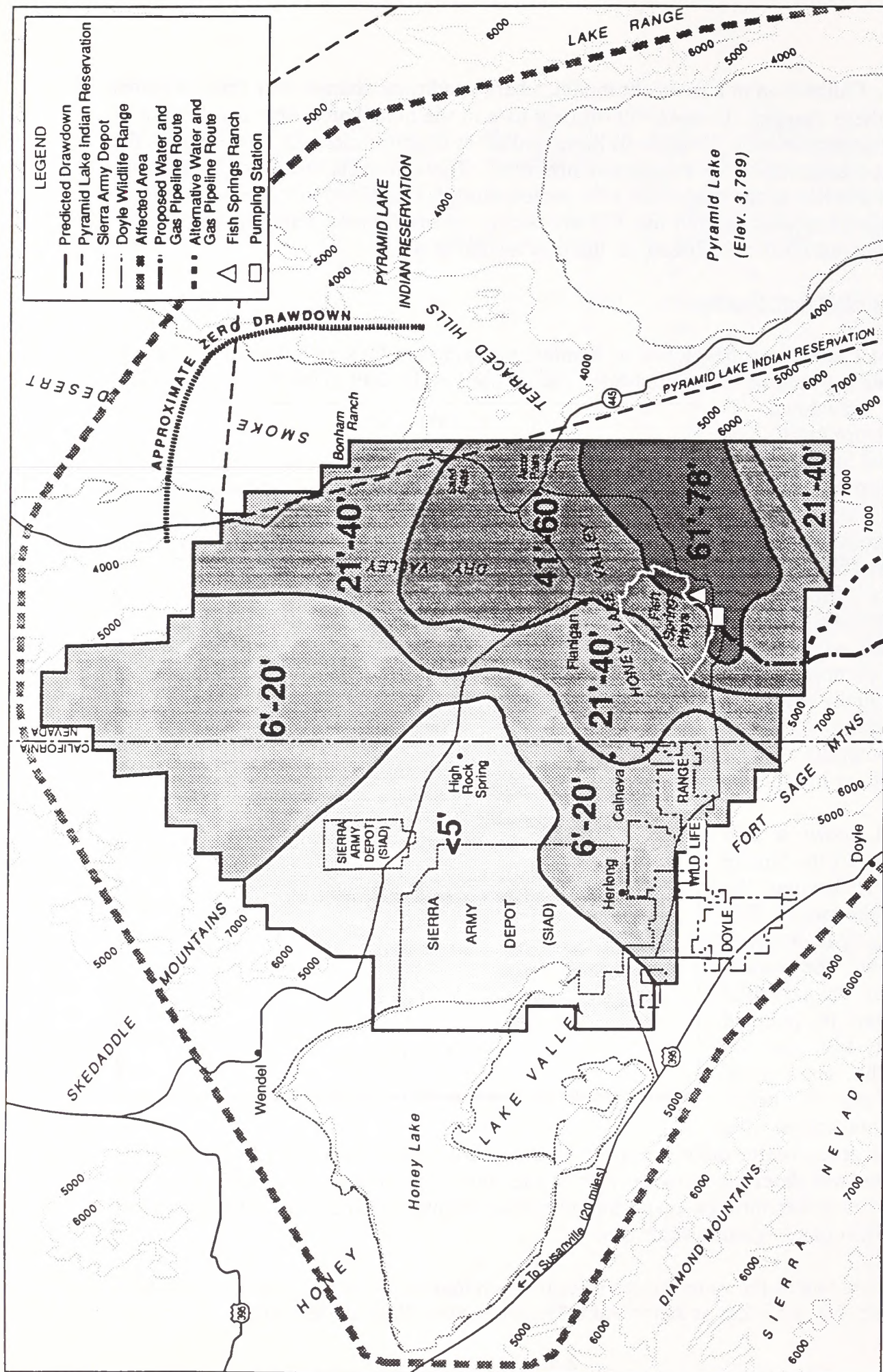
A groundwater model was developed to simulate pumping 13,000 acre-ft/yr at Fish Springs Ranch. Table 4.4-1 shows the groundwater budget used in this EIS to predict impacts. The projected drawdown is shown on Figure 4.4-1. The drawdown is based on an instant pumping rate of 13,000 acre-ft/yr and steady-state conditions where the groundwater table is neither rising nor falling; it therefore represents a worst-case scenario. As proposed, the rate of pumping would increase gradually beginning in 1995 and reach the maximum pumping rate of 13,000 acre-ft/yr in 2015.

Figure 4.4-1 shows a *zero drawdown* line in the Smoke Creek Desert beyond the boundary of the model. The groundwater table between this line and the model boundary has the potential to be lowered by planned pumping at Fish Springs Ranch. The amount of lowering at any one point, however, is not known. No

effects to the groundwater table would be expected north and east of this line. The *zero drawdown* line was determined by estimating the total area of vegetation and playa that would use water either through evaporation or evapo-transpiration equal to the amount of projected reductions in groundwater flow.

Projected drawdown of the water table varies from 78 feet near the pumping center at Fish Springs Ranch, 50 to 55 feet at Astor Pass, 35 feet at Sand Pass, 20 feet along part of the

TABLE 4.4-1	
FUTURE GROUNDWATER BUDGET ASSOCIATED WITH PUMPING FOR THE TRUCKEE MEADOWS PROJECT	
Budget Component	Estimated Quantity (in acre-ft/yr)
RECHARGE	
• Direct infiltration of precipitation	9,339
• Infiltration of runoff	12,829
• Irrigation return	0
• Groundwater inflow	1,331
Total Recharge	~ 23,499
DISCHARGE	
• Groundwater evapotranspiration	4,495
• Withdrawals from wells:	
Truckee Meadows Project	12,983
Other	1,996
• Groundwater outflow westward to Honey Lake	37
• Groundwater outflow northward to Smoke Creek Desert	3,041
• Groundwater outflow eastward to Pyramid Lake Valley	953
Total Discharge	~ 23,505



California/Nevada border, and less than five feet throughout most of the Sierra Army Depot.

Groundwater flow from Honey Lake Valley to the Pyramid Lake Basin would be reduced by about 35 percent, from approximately 1,500 acre-ft/yr to 953 acre-ft/yr. Washoe County proposes to replace this water with an equal amount of acquired Truckee River water rights which would then be dedicated to Pyramid Lake.

Groundwater flow from Honey Lake Valley to the Smoke Creek Desert would be reduced by about 43 percent, from approximately 5,300 acre-ft/yr to 3,041 acre-ft/yr. The current *artesian* elevation of the groundwater table at Bonham Ranch in the Smoke Creek Desert is 3,918 feet. This is the elevation to which groundwater at Bonham Ranch would rise above the surface if it was not confined by relatively impermeable strata. The aquifers and the wells at Bonham Ranch and throughout the modeled part of the Smoke Creek Desert are *artesian*. Planned pumping at Fish Springs Ranch is projected to lower the elevation of the groundwater table at Bonham Ranch by 28 feet. The *artesian* elevation of the water table at the ranch would still be about nine feet above the surface. The projected reduction of subsurface flow and the lowering of the water table could decrease the flow of springs and artesian wells at Bonham Ranch and at other wetlands along the southwest side of the Smoke Creek Desert. Insufficient information exists to accurately quantify the reductions in flow of these springs and wells. Quantification of these projections would provide better information on such adverse effects. A maximum reduction of water flow at these springs and wells of 43 percent would occur if groundwater from Honey Lake Valley was the *only* source of recharge to these springs and artesian wells. Because it is likely that sources other than Honey Lake Valley recharge the southern Smoke Creek Desert, future reductions in spring and well flows would likely be less than 43 percent.

Projected reductions in groundwater flow to the Smoke Creek Desert could potentially impact groundwater flow *from* the Smoke Creek Desert to Pyramid Lake. Groundwater monitoring by the U.S. Geological Survey of wells in the Terraced Hills suggests that a gradient exists from the Smoke Creek Desert toward Pyramid Lake. Baseline flows from the Smoke Creek Desert to the Pyramid Lake Basin have been estimated at about 2,600 acre-ft/yr. Planned pumping at Fish Springs Ranch could reduce the amount of groundwater entering the Pyramid Lake Basin from the Smoke Creek Desert by 873 acre-ft/yr. Washoe County proposes to replace this water with an equal amount of acquired Truckee River water rights which would then be dedicated to Pyramid Lake.

Inflow to, and outflow from, Honey Lake would not change appreciably. The net change is estimated to be 103 acre-ft/yr flowing from beneath Honey Lake eastward toward the modeled area. This estimate was obtained by calculating the net flow to the lake before and after project pumping. Net inflow from Honey Lake to the model area is 1,191 acre-ft/yr. After project pumping, net inflow from the lake to the model area is projected to increase to 1,294 acre-ft/yr. The net change in inflow is 103 acre-ft/yr lost from the aquifers beneath Honey Lake toward the modeled area. If the entire 103 acre-ft/yr discharged into Honey Lake, it would represent less than 0.08 percent of the lake's average annual budget of 130,000 acre-ft/yr from all water sources (Handman et al., 1990).

The estimated time required to reach the drawdown of the water table illustrated in Figure 4.4-1 is 82 years. Planned pumping at Fish Springs Ranch, however, would increase gradually over 20 years. By including these 20 years, the time required to reach the steady-state conditions shown in Figure 4.4-1 would be *approximately* 100 years.

Water Quality

The impacts that groundwater pumping at Fish Springs Ranch could have on regional water quality were estimated by use of a computer model. The model incorporates flow conditions directly from the water-flow model used for this EIS (see Appendix C for details).

The water-quality model simulated the transport of total dissolved solids (TDS) that would occur from Washoe County's planned pumping at Fish Springs Ranch. TDS was assigned to the aquifer based on the 1988 TDS distributions shown on Figure 3.4-3. TDS levels shown in Figure 4.4-2 represent the change in TDS levels by the year 2088 compared to 1988 baseline concentrations; a 100-year period.

The following paragraphs describe the projected water-quality impacts in specific areas.

Fish Springs Ranch and Vicinity: Minor changes in TDS concentrations are projected to occur south and east of the playa near Fish Springs Ranch. An increase of 50 to 100 ppm is projected at the western edge of the playa several miles west of the ranch and one mile north of well P-1 (Figure 4.4-2). An increase of 37 ppm TDS is projected at planned well P-1 at Fish Springs Ranch, and a six to 61 ppm increase is projected in the vicinity of wells P-6, P-8 and P-9. Existing groundwater quality in the area of well P-1 ranges from 162 to 460 ppm TDS. Existing groundwater quality in the area of wells P-6, P-8 and P-9 is about 200 ppm TDS.

Although water of poor quality is located a short distance north of the planned pumping wells, modeling suggests that the water near these wells would not be substantially degraded because groundwater flow in the vicinity of the well field is predominantly to the north and west due to recharge from the Virginia Mountains. In local areas where pumping reverses this gradient by pulling water southward toward the project wells, the flux and resulting flow velocities range from 330 to 5,082 cubic feet per day. In 100 years, this would result in an average migration distance of 160 feet and a maximum distance of 551 feet. Hence, the poor-quality water west and north of the playa would tend to move slowly to the south during the next 100 years.

The area of current TDS levels exceeding 10,000 ppm west of the playa near Fish Springs Ranch would migrate two miles eastward after 100 years of pumping. This would result in an increase of 100 ppm TDS. Impacts to domestic well users in this area would be minor because the water quality is already extremely poor and non-potable. The increase in TDS is not likely to affect the beneficial use status of this water. Near the California/Nevada border, the current poor-quality water containing TDS levels of 10,000 ppm would decrease by 100 ppm. This would be due to a reduction in evapotranspiration caused by a declining water table, thereby allowing the poor-quality water to migrate eastward and allowing lower TDS water to replace it from the west.

LEGEND

-  Areas Where TDS Concentrations Would Increase
-  Areas Where TDS Concentrations Would Decrease
-  Location of Washoe County's Wells for Truckee Meadows Project
-  Proposed Water & Gas Pipeline Routes
-  Alternative Water & Gas Pipeline Routes
-  Pyramid Lake Indian Reservation
-  Sierra Army Depot
-  Doyle Wildlife Range
-  Affected Area
-  Fish Springs Ranch
-  Pumping Station
-  Groundwater Model Boundary

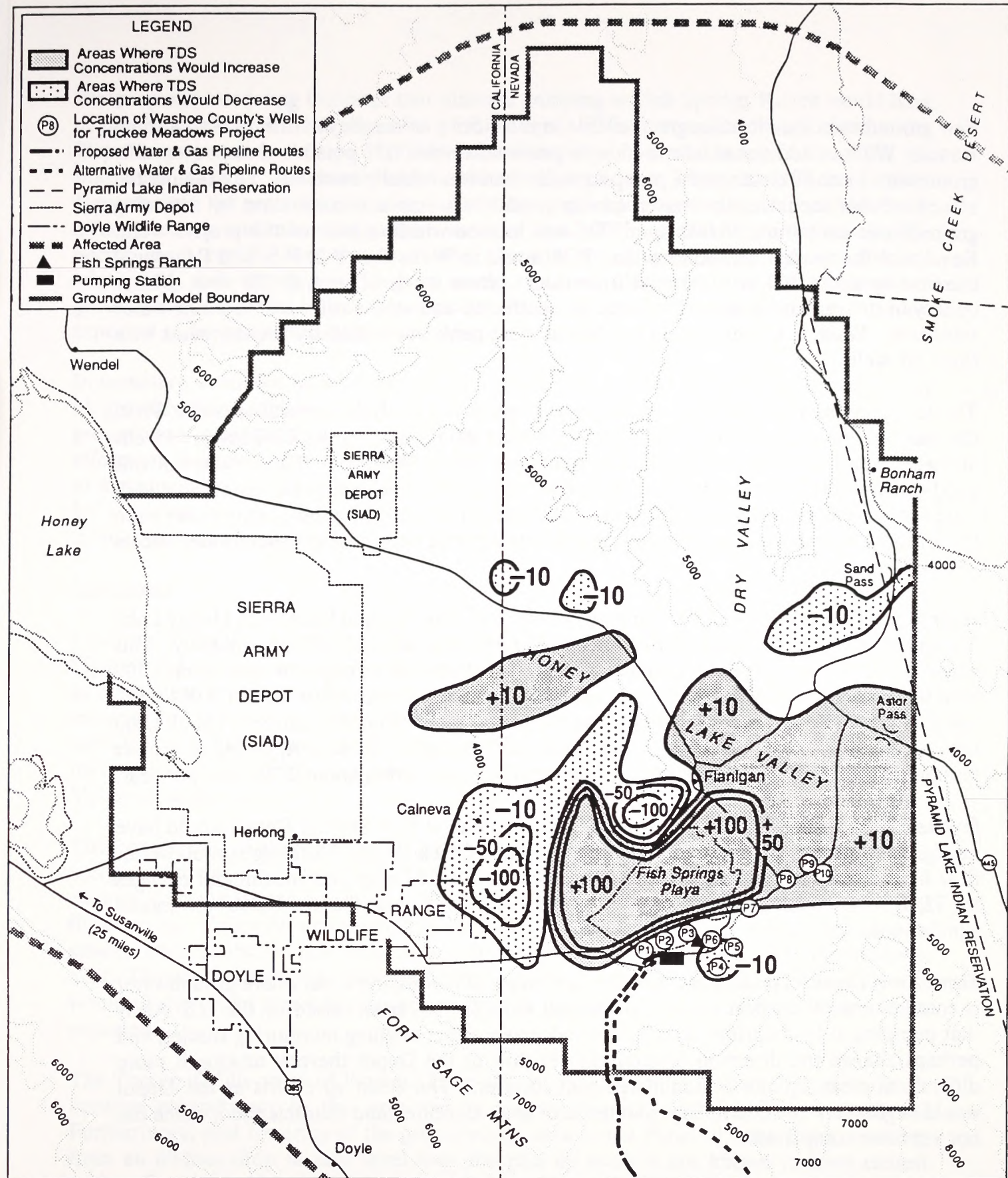


Figure 4.4-2

Computer Generated Changes in TDS Concentrations after 100 Years of Pumping at Fish Springs Ranch

(Some Localized Areas May Have Higher or Lower TDS Values than Indicated in the Figure)



0 3
MILES

Contour Interval = 1,000 ft.

Few groundwater-quality data are available in the vicinity of the playa north of Fish Springs Ranch. Without additional information to prove otherwise, it is possible that poor-quality groundwater occurs closer to the pumping wells than was initially modeled. To examine the effects of this scenario, the water quality model was run a second time by assuming groundwater containing 50,000 ppm TDS was located within a mile of the project wells. Results of the model run indicate that TDS levels in Wells P-1, P-2, P-5, and P-6 would increase by about 800 to 5,000 ppm from their current levels of several 100 ppm. Water quality in the remaining six wells would be unaffected and would still meet drinking water standards. Washoe County would be able to meet peak water-delivery requirements with these six wells.

The scenario described in the preceding paragraph is not likely for several reasons. First, the only well in the playa has a TDS level of about 200 ppm. Existing TDS levels in wells along the southern edge of the playa are between 200 to 700 ppm. The location of this good-quality water, and the fact that a steady-state distribution cannot be maintained with water containing 50,000 ppm TDS in this area due to the influx of good-quality water from the Virginia Mountains, suggest that it is unlikely that this poor-quality groundwater occurs so near the project wells.

Astor Pass: The total mass of TDS in groundwater entering Pyramid Lake from Honey Lake Valley through Astor Pass would decrease by 35 percent or about 1,300 tons annually. This would occur due to a 35 percent reduction in groundwater flow through the pass, from 1,500 acre-ft/yr to 953 acre-ft/yr. At an average TDS concentration at Astor Pass of 2,064 ppm, the mass of TDS that could potentially reach Pyramid Lake from this source is about 4,000 tons per year. If outflows through Astor Pass are reduced to 953 acre-ft/yr due to project pumping, the mass of TDS entering the lake would be reduced to about 2,700 tons per year.

Smoke Creek Desert/Sand Pass: Groundwater pumping at Fish Springs Ranch would have negligible impacts on the water quality of the Smoke Creek Desert. Although groundwater flow from Honey Lake Valley is toward the Smoke Creek Desert, no meaningful changes in TDS concentrations are projected in the Smoke Creek Desert based on model simulations.

Sierra Army Depot: The Depot is now in the process of identifying areas where groundwater is contaminated from past disposal practices. Concern has been raised by the U.S. Army that pumping at Fish Springs Ranch could adversely affect ongoing monitoring studies, and perhaps change the direction of groundwater flow at the Depot thereby making it more difficult to clean up the contaminated groundwater. The clean-up efforts at the Depot would begin after all contaminant plumes have been identified and characterized, which has not yet been completed.

Pumping at Fish Springs Ranch is projected to lower the groundwater table at the Depot by an average of five feet after 100 years. This could lower water levels in wells that are used to monitor shallow groundwater at the Depot. This could adversely impact the Army's remediation program. However, remediation efforts to clean up the contaminated plumes would be expected to be completed by this time.

Water-quality modeling indicates that planned pumping at Fish Springs Ranch would have negligible impacts on TDS migration at the Depot. The change in flow velocities at the Depot is projected to average 0.0008 to 0.0026 feet/day. At a retardation factor of 2.3, the maximum distance a contaminant would travel from the Depot in 100 is 37 feet. Nevertheless, the potential exists for contaminant plumes to migrate, which could adversely affect clean up and monitoring efforts at some sites. If the drawdown of the water table occurs more rapidly than projected, the potential for adverse impacts to the Depot's monitoring and remediation program could increase. However, the overall extent of groundwater contamination is not expected to be affected, and remediation efforts are expected to be completed before such impacts could occur.

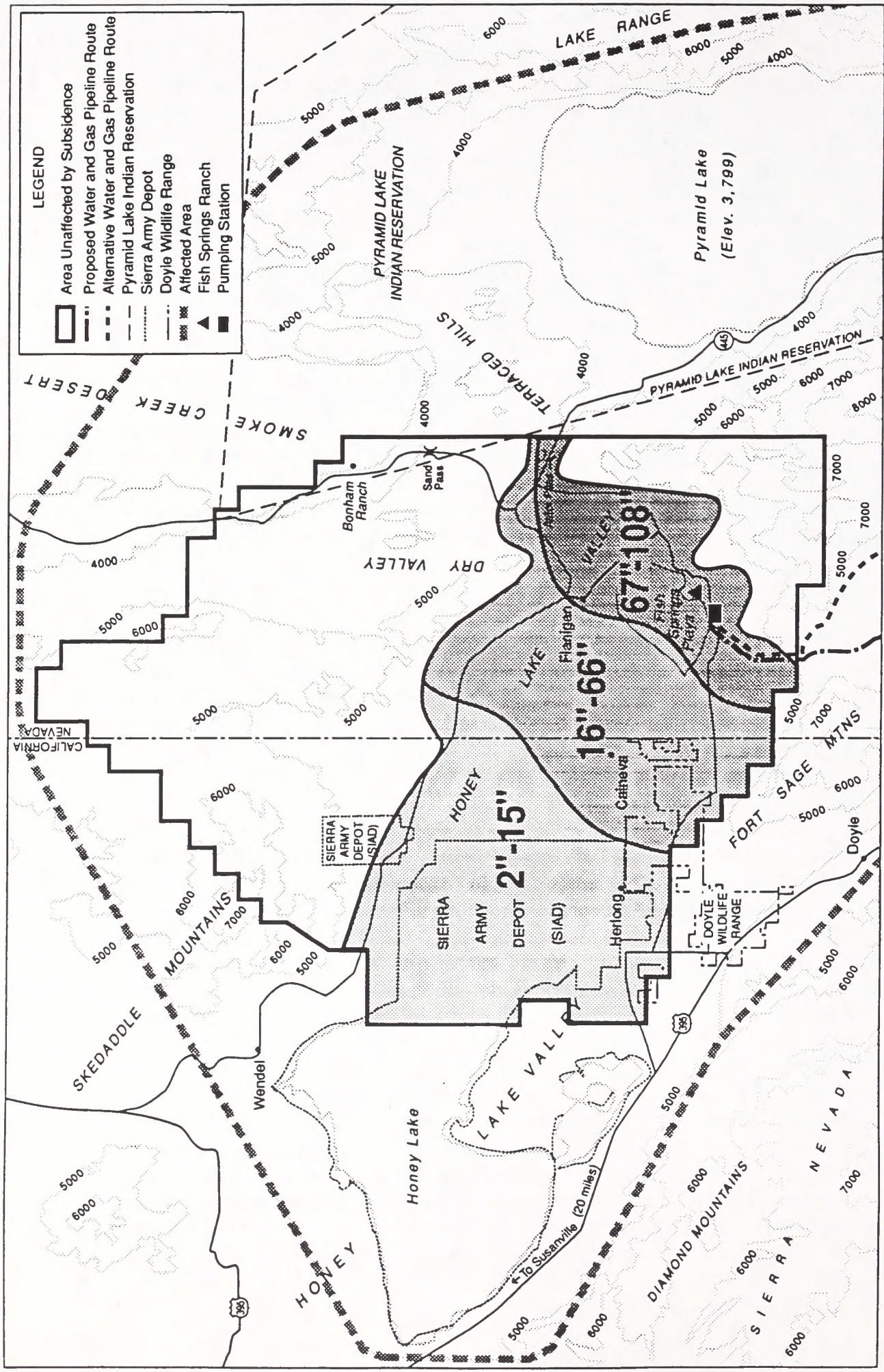
In summary, available data indicate that no substantial impacts would occur to the quality of groundwater supplies at the Sierra Army Depot, nor would the overall extent of groundwater contamination be affected by pumping at Fish Springs Ranch. Remediation efforts are expected to be completed before any measurable changes in groundwater levels or movement would occur. However, because available data are limited, the potential exists for a decline in the quality of groundwater supplies at the Depot and adverse impacts to monitoring and remediation efforts. This potential is very small.

Subsidence

Lowering of the water table from groundwater pumping can cause subsidence at the surface. Figure 4.4-3 shows the range of subsidence in inches that is possible in Honey Lake Valley as a result of pumping at Fish Springs Ranch. Several hundred years would probably be required to reach maximum subsidence as discussed in Appendix C. Estimates of subsidence are based on assumed rock properties and a semi-infinite deposit of compressible materials such as sandstone, siltstone, and claystone. Available well logs of Honey Lake Valley were also used.

The boundaries of the subsidence area shown on Figure 4.4-3 coincide with the valley margins where bedrock is exposed. The bedrock would not subside when groundwater levels change. Subsidence can only occur in unconsolidated granular sediments such as the valley fill deposits. Valley fill deposits in the southern Smoke Creek Desert are not expected to subside because the *artesian* pressure would remain above the land surface in the modeled area. The *artesian* elevation throughout the remainder of the southern Smoke Creek Desert would likely still be above the surface or close to the surface and subsidence would not be expected.

The Terraced Hills north of Pyramid Lake are not expected to be impacted by subsidence because groundwater in this area occurs largely in joints and fractures in bedrock. Furthermore, past lowering of the groundwater table in the Pyramid Lake Basin resulting from an 80-foot drop in lake level over the past 80 years is not known to have caused surface fissuring in the alluvial materials near the lake. Moreover, because Washoe County would replace all projected reductions in groundwater to Pyramid Lake with Truckee River water, subsidence in the Pyramid Lake Basin caused by pumping at Fish Springs Ranch would not be expected to occur.



LEGEND

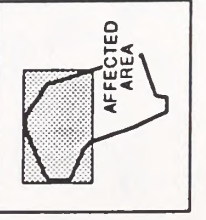
- Area Unaffected by Subsidence
- Proposed Water and Gas Pipeline Route
- Alternative Water and Gas Pipeline Route
- Pyramid Lake Indian Reservation
- Sierra Army Depot
- Doyle Wildlife Range
- Affected Area
- Fish Springs Ranch
- Pumping Station

0 2 4
MILES

Contour Interval = 1,000 ft

4.4-3

Estimated Subsidence After Several Hundred Years of Pumping at Fish Springs Ranch (in Inches)



Subsidence can damage buildings by cracking foundations. This would be of most concern in the vicinity of the wells and other facilities at Fish Springs Ranch because these areas would experience the greatest *variation* in drawdown over the shortest time and distance; this is referred to as differential subsidence. Depending on the composition of the foundation materials of the facilities at Fish Springs Ranch, the time required to dissipate excess pore pressures, and thereby initiate subsidence, could vary from days to years.

Fissuring has been reported approximately six miles north of Fish Springs Ranch. The cause of the fissuring is not known, but it could have been initiated by pumping at Fish Springs Ranch. Other possible causes include fault creep or desiccation cracks caused by prolonged drought.

Beyond two miles from the pumping wells, damage to buildings is not likely to occur because the change in water levels would decrease greatly. For structures several hundred feet long or less, the change in water levels within the area underlying these structures would be quite small. Larger structures are not known to exist in Honey Lake Valley in areas where subsidence would be more than 15 inches. The highest gradient projected beyond two miles from the wells is a change of one foot in water level for every 1,000 linear feet. This decreases to a change of three feet for every 10,000 linear feet in the vicinity of the Sierra Army Depot.

At the Sierra Army Depot where drawdown of the water table is projected to average five feet, less than five inches of subsidence would be expected. Damage from differential settling at the Depot would not be expected to occur because the change in water levels over distance is only three feet per 10,000 feet; this is a very shallow gradient. At the western and southwestern edges of the model, groundwater drawdown is projected to be less than two feet. This amount of drawdown is not considered sufficient to cause serious subsidence or differential settlement because the projected changes are small and the resulting gradients are nearly flat. Moreover, groundwater level fluctuations of at least two feet occur naturally in response to seasonal hydrologic influences with no observed subsidence.

The storage capacity of the aquifer would be decreased depending on the soil type and the amount of drawdown at a given location. In areas where two to 15 inches of subsidence are projected (Figure 4.4-3), 0.3 to 5.1 percent of the initial storage capacity could be lost, which is equivalent to 1,352 acre-feet. Where 16 to 66 inches and 67 to 108 inches of subsidence are projected, 2.1 to 5.1 percent of initial storage capacity could be lost, which is equivalent to 3,988 to 4,294 acre-feet, respectively.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

Lemmon Valley

By 2015, 800 acre-ft/yr of groundwater from Honey Lake Valley would be delivered to Lemmon Valley. Of this amount, an estimated 50 percent would be used consumptively from evapotranspiration by lawns and other plants (Moser, 1992). The remaining 50 percent (400 acre-ft/yr) would be treated in one or both of the existing wastewater treatment facilities in Lemmon Valley.

Final disposal of the treated wastewater is not known at this time. It could be discharged directly to Lemmon playa where an estimated 50 percent (200 acre-ft/yr) would evaporate and the remaining 200 acre-ft/yr would recharge the groundwater system beneath the playa. The infiltrating wastewater would increase the quantity of groundwater in Lemmon Valley which is currently overappropriated. The quality of the discharged wastewater would not be allowed to degrade the quality of the receiving groundwater because discharges could not exceed water quality standards established by the State of Nevada. Other disposal options for the treated wastewater include irrigation of recreation facilities such as golf courses and baseball fields, and the maintenance and enhancement of wetlands in the valley.

More than 2,300 septic systems were in operation in Lemmon Valley in 1989 (Regional Water Planning and Advisory Board, 1990). These systems filter liquid organic effluent through biologically active soils that are charged with oxygen and other gases. These systems do not operate adequately in areas of near-surface groundwater because the liquid effluent mixes with saturated soil which is largely depleted of oxygen and has low levels of biological activity. The result can be contamination of groundwater with nitrates, ammonia, and possibly pathogens, which pose a risk to human health. If increased amounts of wastewater are discharged to Lemmon playa, adverse impacts to the operation of septic systems would be expected only to those systems that are very close to the wastewater discharge point.

Spanish Springs Valley

By 2015, 12,200 acre-ft/yr of groundwater from Honey Lake Valley would be delivered to Spanish Springs Valley. The specific wastewater treatment and disposal facilities have not been identified at this time. A variety of wastewater disposal methods are available including irrigation of recreation facilities and open space, wetlands enhancement, and recharge basins. In the event that wastewater is treated and disposed of through recharge basins in Spanish Springs Valley, 3,000 acre-ft/yr could recharge the aquifers in the valley. Depending on the location of the basins, this infiltration could increase groundwater flows from Spanish Springs Valley to the Truckee Meadows. Data are not available to quantify this potential impact. The U.S. Geological Survey is currently investigating groundwater conditions in the valley. The quality of the discharged water would not be allowed to degrade the quality of the receiving groundwater because discharges would be subject to Nevada State regulations.

4.4.1.3 Conclusions

Direct impacts to groundwater from construction and operation of the pipelines along the proposed rights-of-way would be negligible. Indirect impacts associated with the proposed rights-of-way could occur in Honey Lake Valley. Modeling indicates a maximum decline in the water table of 78 feet at Fish Springs Ranch after 100 years of pumping. Other areas of projected drawdown are as follows: 50 to 55 feet at Astor Pass, 35 feet at Sand Pass, 20 to 25 feet along part of the California/Nevada border, and less than five feet throughout the Sierra Army Depot.

Groundwater flow from Honey Lake Valley to the Pyramid Lake Basin could be reduced by about 1,400 acre-ft/yr. Washoe County proposes to acquire and then dedicate to Pyramid Lake an equivalent amount of Truckee River water rights. Groundwater flow from Honey Lake Valley to the Smoke Creek Desert could be reduced by 43 percent, from 5,300 acre-ft/yr to 3,041 acre-ft/yr. Average TDS concentrations at Astor Pass could increase by 40 ppm. The total mass of TDS entering Pyramid Lake from Astor Pass would decrease by about 1,300 tons per year because of the reduced flow of groundwater to the lake from this area.

Groundwater flow to Honey Lake could be reduced by as much as 103 acre-ft/yr. This reduction would represent less than 0.08 percent of the lake's average annual budget of 130,000 acre-ft/yr from all water sources.

Groundwater near the county's planned well field would probably not be substantially degraded due to pumping at Fish Springs Ranch. If, however, it is assumed that very poor-quality groundwater exists close to the pumping wells, then TDS levels in some wells would increase from their current levels of several 100 ppm TDS to as much as 5,000 ppm TDS. Impacts to the water quality of the 10 or so domestic well users in Honey Lake Valley would not be expected to be significant.

Available data indicate that no substantial impacts would occur to the quality of groundwater supplies at the Sierra Army Depot, nor would the overall extent of groundwater contamination at the Depot be affected by pumping at Fish Springs Ranch. Because data are limited, the potential nevertheless exists for a decline in the quality of groundwater supplies at the Depot and adverse impacts to monitoring and remediation efforts. This potential is very small.

Drawdown of the water table is projected to cause an average subsidence of 87 inches within a two-mile radius of the pumping wells. Differential settling could occur within this area causing damage to existing structures. Beyond this area, an average subsidence of 43 inches is estimated and differential settling would be less evident. At the Sierra Army Depot, an average of five inches of subsidence is projected. Damage from differential subsidence at the Depot would not be expected. The projected subsidence could take several hundred years to occur.

The *indirect* impacts to groundwater in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows would be chiefly from wastewater discharges associated with population

growth. These effects, however, are poorly known in Spanish Springs Valley because the location(s) and methods of wastewater disposal have not been identified. In general, however, no adverse impacts to groundwater quality would be expected.

4.4.2 *Alternative Routes*

No impacts to groundwater are expected from installation of the water and gas pipelines along any of the alternative routes. The pipelines would be buried to a minimum depth of three feet below the surface and a maximum depth at stream crossings of about 12 feet. Impacts to areas of shallow groundwater would be temporary and groundwater levels would be expected to return to pre-pipeline conditions shortly after installation.

4.4.3 *No Action Alternative*

Under the no action alternative, the rights-of-way would be denied. Fish Springs Ranch would continue to pump 5,910 acre-ft/yr for irrigation. The owners of Fish Springs Ranch would retain the rights to approximately 14,000 acre-ft of water, some portion of which would presumably be put to beneficial use. The current steady-state conditions of the groundwater system in eastern Honey Lake Valley, as well as the current groundwater quality, would be maintained.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.4.3.1 *Supply Side Sub-Alternative*

Part of this sub-alternative is the acquisition of 6,900 acre-ft/yr of Truckee River irrigation rights. Conversion of these rights to municipal and industrial uses would have negligible impacts on groundwater in the affected area.

Approximately 3,000 acre-ft/yr of groundwater would also be available to the community under this sub-alternative. The availability of this water would be subject to approval by the State Engineer. Impacts to groundwater from this pumping cannot be assessed because the locations of the four new wells associated with this sub-alternative are not known.

- ***Lemmon Valley***

By 2015, 223 acre-ft/yr of water would be delivered to Lemmon Valley under this sub-alternative. Of this amount, an estimated 50 percent would be used consumptively from evapotranspiration by lawns and other plants (Moser, 1992). The remaining 50 percent (112 acre-ft/yr) could be treated in one or both of the existing wastewater treatment facilities in

Lemmon Valley. The wastewater could also be sewered back to the Truckee Meadows Water Reclamation Facility for disposal in the Truckee River.

If the treated wastewater is discharged to Lemmon playa, approximately half would evaporate and the other half, or about 56 acre-ft/yr, could enter the groundwater system resulting in a minor amount of recharge to the valley which is currently overappropriated. The quality of the discharged wastewater would not be allowed to degrade the quality of the receiving groundwater because the discharges could not exceed water quality standards established by the State of Nevada. Alternatively, the 112 acre-ft/yr of treated wastewater could be used to irrigate recreation facilities or used to maintain and enhance existing wetlands in the valley.

Potential impacts to septic systems in Lemmon Valley would be negligible because only 56 acre-ft/yr would be available to infiltrate into the ground through this sub-alternative.

- *Spanish Springs Valley*

By 2015, 3,320 acre-ft/yr of water would be delivered to Spanish Springs Valley under this sub-alternative. Of this amount, an estimated 50 percent would be used consumptively from evapotranspiration by lawns and other plants (Moser, 1992). The remaining 50 percent, or 1,660 acre-ft/yr, would be treated and disposed. The wastewater could also be sewered back to the Truckee Meadows Water Reclamation Facility for disposal in the Truckee River.

If this treated wastewater is discharged in Spanish Springs Valley, approximately half would evaporate and the other half, or 830 acre-ft/yr, could enter the groundwater system resulting in a minor amount of recharge to the valley which is currently overappropriated. Depending on where a wastewater treatment facility is located in Spanish Springs Valley, this infiltration could increase groundwater flows from Spanish Springs Valley to the Truckee Meadows. Data are not available to quantify this potential impact. The U.S. Geological Survey is currently investigating groundwater conditions in the valley. The quality of the discharged wastewater would not be allowed to degrade the quality of the receiving groundwater because the discharges could not exceed water quality standards established by the State of Nevada. Alternatively, the treated wastewater could be used to irrigate recreation facilities or used to maintain and enhance existing wetlands in the valley.

- *Truckee Meadows*

By the year 2015, this sub-alternative would support an additional 22,700 people in the Truckee Meadows using 6,333 acre-ft/yr of water. Approximately one half of this supply, or 3,167 acre-ft/yr, would be wastewater that would be treated and disposed. Disposal could be through a variety of methods. Some wastewater could pass through the Truckee Meadows Water Reclamation Facility where discharges would enter the Truckee River. This would have negligible impacts to groundwater in the Truckee Meadows. Alternatively, wastewater could be disposed of via the South Truckee Meadows Wastewater Treatment Plant or some other method of wastewater disposal. If the wastewater is disposed of through recharge basins, part would enter the groundwater system resulting in a minor amount of recharge to the Truckee Meadows basin. The quality of the discharged

wastewater would not be allowed to degrade the quality of the receiving groundwater because the discharges could not exceed water quality standards established by the State of Nevada.

4.4.3.2 Demand Side Sub-Alternative

This sub-alternative would have negligible effects on the quality or quantity of groundwater in the Reno-Sparks metropolitan area. Conservation would decrease the amount of water used for outdoor landscaping, which could reduce the amount of water that returns to the groundwater system through percolation and runoff. But less groundwater would also be used under this sub-alternative, thereby helping to maintain groundwater levels in the metropolitan area.

4.4.3.3 Negotiated Settlement Sub-Alternative

- ***Lemmon Valley***

By 2015, 800 acre-ft/yr of groundwater would be delivered to Lemmon Valley under this sub-alternative. Of this amount, an estimated 50 percent would be used consumptively from evapotranspiration by lawns and other plants (Moser, 1992). The remaining 50 percent would be treated in one or both of the existing wastewater treatment facilities in Lemmon Valley or sewer back to the Truckee Meadows Water Reclamation Facility for disposal in the Truckee River. The final disposal method for the treated wastewater is not known at this time.

If the treated wastewater is discharged to Lemmon playa, 200 acre-ft/yr would evaporate and the remaining 200 acre-ft/yr would recharge the groundwater system beneath the playa. The infiltrating wastewater would increase the quantity of groundwater in Lemmon Valley which is currently overappropriated. The quality of the discharged wastewater would not be allowed to degrade the quality of the receiving groundwater because discharges could not exceed water quality standards established by the State of Nevada. Other disposal options for the treated wastewater include irrigation of recreation facilities such as golf courses and baseball fields, and the maintenance and enhancement of wetlands in the valley.

More than 2,300 septic systems were in operation in Lemmon Valley in 1989 (Regional Water Planning and Advisory Board, 1990). These systems filter liquid organic effluent through biologically active soils that are charged with oxygen and other gases. These systems do not operate adequately in areas of near-surface groundwater because the liquid effluent mixes with saturated soil which is largely depleted of oxygen and has low levels of biological activity. The result can be contamination of groundwater with nitrates, ammonia, and possibly pathogens, which pose a risk to human health. If increased amounts of wastewater are discharged to Lemmon playa, adverse impacts to the operation of septic systems would be expected only to those systems that are very close to the wastewater discharge point.

Spanish Springs Valley

By 2015, 12,200 acre-ft/yr of groundwater would be delivered to Spanish Springs Valley under this alternative. The final disposal method of the treated wastewater is not known at this time. It could be treated and discharged to recharge basins, used to irrigate recreation facilities, used to maintain or enhance existing wetlands in the valley, or sewered back to the Truckee River via the Truckee Meadows Water Reclamation Facility.

If this wastewater is treated and disposed of through recharge basins in Spanish Springs Valley, about 3,000 acre-ft/yr could recharge aquifers in the valley. This would occur assuming that half of the imported water was used consumptively and half of the treated water infiltrated to the groundwater system (Moser, 1992). This recharge would increase the quantity of groundwater in Spanish Springs Valley which is currently overappropriated. Depending on where a wastewater treatment facility is located in Spanish Springs Valley, this infiltration could increase groundwater flows from Spanish Springs Valley to the Truckee Meadows. Data are not available to quantify this potential impact. The U.S. Geological Survey is currently investigating groundwater conditions in the valley. Water quality standards established by the State of Nevada would prohibit the discharged wastewater from degrading the quality of the receiving groundwater.

Truckee Meadows

By the year 2015, this sub-alternative would support an additional 92,800 people in the Truckee Meadows using 25,890 acre-ft/yr of water. Approximately half of this water supply, or 12,950 acre-ft/yr, would be wastewater that would be treated and disposed. Disposal could be through a variety of methods. Some wastewater could pass through the Truckee Meadows Water Reclamation Facility for discharge to the Truckee River. This would have negligible impacts to groundwater in the Truckee Meadows. Alternatively, wastewater could be disposed of via the South Truckee Meadows Wastewater Treatment Plant or some other method of wastewater disposal. If the wastewater is disposed of through recharge basins, part would enter the groundwater system resulting in recharge to the aquifer. The quality of the discharged wastewater would not be allowed to degrade the quality of the receiving groundwater because the discharges could not exceed water quality standards established by the State of Nevada.

4.5 WETLANDS

4.5.1 Proposed Action

See Figure 3.5-1 for the location of wetlands and related habitats discussed in this section.

4.5.1.1 Direct Impacts

The proposed rights-of-way would cross many creeks and dry washes that support areas classified as riverine systems on the *National Wetlands Inventory* maps, but have no vegetation component within the defined channel and do not support adjacent palustrine

wetlands. Pipeline construction in these drainages would not affect wetlands habitat. These crossings are discussed in greater detail in Section 4.3.

The gas pipeline would cross three palustrine emergent and scrub/shrub wetlands and riverine systems on private land at Hay, Wilcox, and Cottonwood Creeks. Vegetation at these crossings consists of willows, cottonwoods, other shrubs, grasses and emergent herbaceous vegetation. Approximately 1.4 acres of wetland habitat would be disturbed for construction of the gas pipeline. Rapid succession by native plant species would be expected in these areas due to their small size and relatively abundant supplies of moisture.

Standard operating procedures for construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing impacts to wetlands (see Section 2.1.6). Pipeline construction affecting wetlands on private lands, as well as on public lands, would also require the acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect wetlands habitat. These stipulations might include grading and reseeding the wetlands with appropriate plant species after construction is completed. Long-term impacts to wetlands and related habitats from construction of the proposed Bedell Flat pipelines would be expected to be negligible.

4.5.1.2 Indirect Impacts

- *Water Source Area*

Planned groundwater pumping at Fish Springs Ranch is expected to reduce the availability of water to some wetlands. Figure 4.5-1 shows the projected drawdown of the groundwater table after 100 years of pumping at Fish Springs Ranch. Expected impacts to each of the wetlands and open-water habitats discussed in Chapter 3.5 are described below.

Little Fish Springs

The 32-acre wetland on private land at Little Fish Springs is supported by both surface flows from Cottonwood Creek and by groundwater discharge at Little Fish Springs. Data are not available to quantify how much of this wetland is supported by each source. No impacts to that part of the wetland supported by Cottonwood Creek would be expected because the creek would not be affected by planned pumping at Fish Springs Ranch. The water table beneath this wetland is about 20 feet deep. Pumping at Fish Springs Ranch is projected to lower the water table by an additional 61 to 78 feet. Drawdown of the water table would result in some reduction of the size, value, and function of that part of the wetland that is sustained by flow from Little Fish Springs. Although this impact cannot be quantified with available data, a maximum of 32 acres could be affected.

Fish Springs Playa

Fish Springs Playa is classified as a lacustrine system on the *National Wetlands Inventory* map, but not as a wetland. The playa is intermittently flooded from surface runoff during

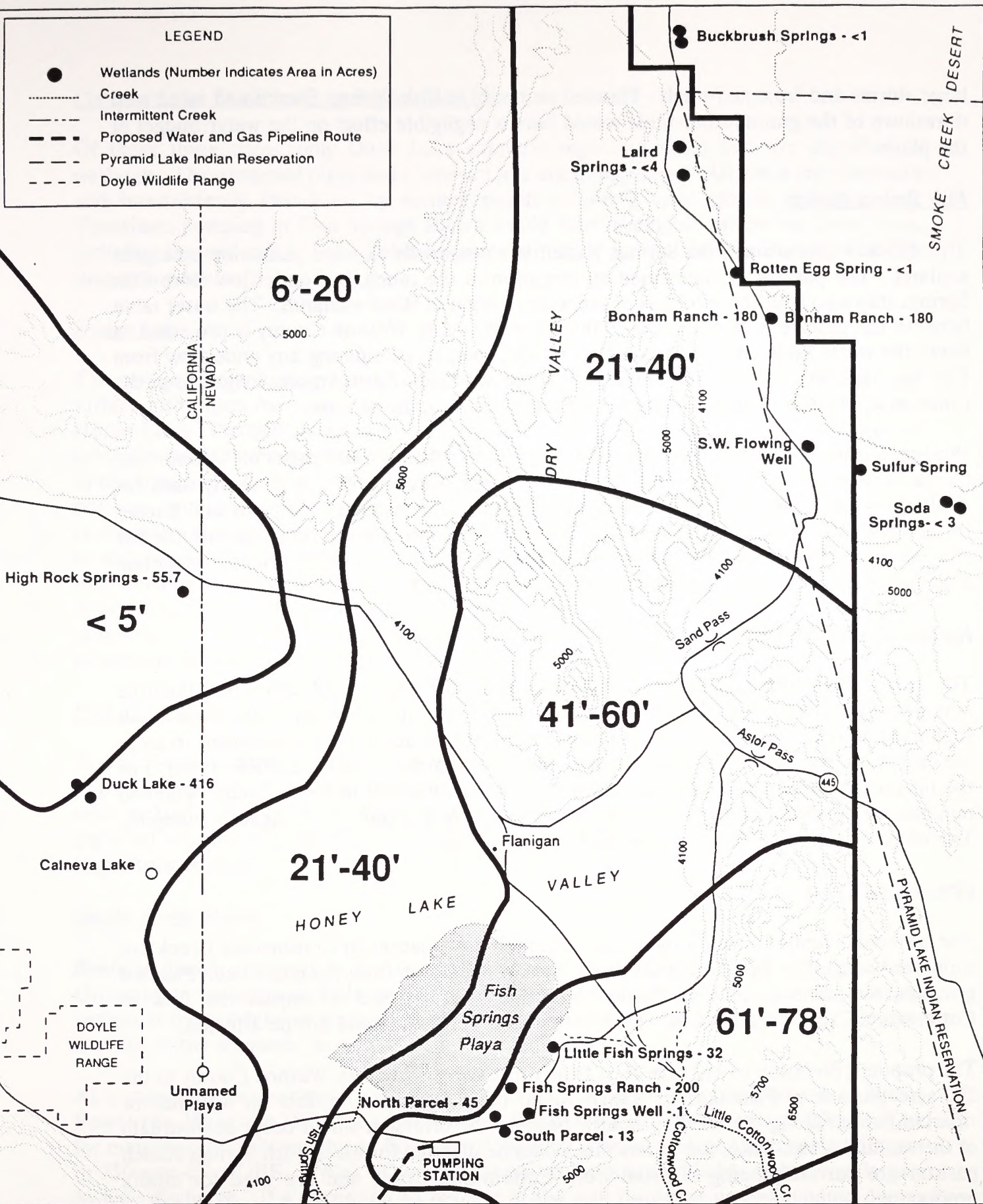


Figure 4.5-1

Maximum Predicted Drawdown of Water Table
In the Water Source Area (In Feet)

large storms and from snowmelt. Planned pumping at Fish Springs Ranch and associated drawdown of the groundwater table would have a negligible effect on the water budget of the playa.

Fish Springs Ranch

The 200-acre pasture at Fish Springs Ranch is a seasonally flooded palustrine emergent wetland. The pasture is maintained by irrigation at the ranch, but underflow from Fish Springs may also contribute to part of the water budget of these wetlands. The water table beneath the pasture is 20 feet deep. Planned pumping by Washoe County is projected to lower the water table an additional 61 to 78 feet, thereby eliminating any underflow from Fish Springs that may be maintaining part of this wetland. Furthermore, irrigation at the ranch would be terminated, ending the pasture's main supply of water.

Washoe County proposes to purchase 442 acre-feet of existing water rights on Cottonwood Creek located a few miles east of the ranch. These water rights are currently used for alfalfa production near the creek. This water would be transported via pipes and ditches to the ranch to maintain these wetlands. Data are not available to fully quantify the net effects. If the 442 acre-feet are properly applied, it would likely be sufficient to maintain a wetland similar to the 200-acre wetland now at the ranch.

North and South Parcels

The north and south parcels near Fish Springs Ranch support 58 acres of palustrine emergent wetlands, primarily wet meadows. The wet meadows in both parcels are supported by irrigation return flows. Only three of the 58 acres were determined to meet the criteria as jurisdictional wetlands that would be regulated by the COE (JBR, 1990). For the purpose of this impact analysis, all 58 acres are considered to be wetlands. Planned pumping by Washoe County at the ranch would result in a cessation of irrigation pumping. Therefore, the entire 58 acres of wetlands would be lost.

Cottonwood Creek

The wetlands identified within the stream channel and adjacent to Cottonwood Creek are supported entirely by flow within the creek and by infiltration from the creek bed. Planned groundwater pumping at Fish Springs Ranch is not expected to impact the flow of Cottonwood Creek (Section 4.3). Therefore, these wetlands would not be affected.

The proposed diversion of 442 acre-ft/yr from Cottonwood Creek by Washoe County to the 200-acre pasture at Fish Springs Ranch would have negligible impacts on wetlands or riparian habitat along the creek, primarily because the diversion would occur downstream of the wetland areas. Also, the waters that would be diverted for use at Fish Springs Ranch pasture are currently being diverted from Cottonwood Creek and are used for alfalfa production.

Calneva Lake, Duck Lake, and Unnamed Playa

Of these three areas, only Duck Lake supports vegetated areas that are classified as wetlands. The unnamed playa and Calneva Lake are unvegetated. All areas are seasonally and intermittently inundated by surface runoff following large storms and snowmelt. Therefore, pumping at Fish Springs Ranch would have negligible effects on these areas, including the wetlands at Duck Lake, because their water is supplied by surface flows rather than groundwater.

Honey Lake

The wetlands surrounding Honey Lake are primarily supplied by surface runoff and sub-surface infiltration from the Susan River and from other streams and creeks that flow into Honey Lake. Planned pumping at Fish Springs Ranch is projected to increase the flow of groundwater from the aquifers beneath Honey Lake toward eastern Honey Lake Valley by as much as 103 acre-ft/yr. All or part of this 103 acre-ft/yr may discharge to the lake. The potential reduction of 103 acre-ft/yr entering Honey Lake represents less than 0.08 percent of the lake's average annual budget of 130,000 acre-ft/yr from all water sources (Handman et al., 1990). This reduction in the lake's annual water budget is insignificant to the maintenance of wetlands habitat, considering that the lake fluctuates widely from season to season and has dried up more than a dozen times since 1859 (Rockwell, 1990; recent observations). Therefore, planned groundwater pumping at Fish Springs Ranch would not be expected to affect any of the wetlands at Honey Lake.

High Rock Spring

The 55.7-acre wetland at High Rock Ranch is supported by irrigation flows derived from High Rock Spring. Planned pumping at Fish Springs Ranch is projected to lower the water table at High Rock Spring by three to four feet. Impacts to these wetlands would not be expected because they are maintained by irrigation ditches from groundwater pumping at High Rock Ranch.

Smoke Creek Desert

Bonham Ranch: Impacts to the 180 acres of wetlands at Bonham Ranch are uncertain. Groundwater pumping at Fish Springs Ranch could reduce the discharge rate of wells and springs at the ranch by as much as 43 percent after 100 years of pumping, thereby reducing the size of the wetlands, as well as their value and function.

At a maximum evapotranspiration rate of four feet per year (Nevada Division of Water Resources, 1971), the 180 acres of wetlands at Bonham Ranch would require 720 acre-ft/yr for maintenance. The combined flow rate of the four artesian wells at the ranch is 450 gpm or 730 acre-ft/yr (JBR, 1990a). Therefore, these wetlands are probably maintained largely by well discharge. If a maximum 43 percent of the well discharge was eliminated due to pumping at Fish Springs Ranch, then these wetlands could be deprived of 300 acre-ft/yr of water.

The potential reduction in water flow to the Ranch would not necessarily mean that the *acreage* of wetlands in this area would also be reduced by 43 percent; it could be more or less than 43 percent. Insufficient information exists to quantify the acreage of wetlands that could be lost at Bonham Ranch. Nevertheless, the reduction in water supply to these wetlands by as much as 43 percent would result in some reduction in the size, value, and function of this 180-acre wetland over the course of the 100 years required to reach steady-state conditions.

Other Wetlands in the Smoke Creek Desert: Groundwater flow could also be reduced to 15 acres of other wetlands in the Smoke Creek Desert after a hundred years of pumping. These wetlands occur at Rotten Egg Spring, Laird Springs, Buckbrush Springs, Soda Springs, and at several other isolated springs and seeps along the western and southern edges of the Smoke Creek Desert. Some reduction in the size, value, and function of these wetlands would be likely. That reduction cannot be quantified with existing data, especially considering that some of these wetlands are outside the modeled area. A maximum of 15 acres could be affected.

Terraced Hills

The lacustrine systems in this area are essentially devoid of vegetation and do not constitute wetlands. The water regime for these areas is associated with the fluctuating shoreline of Pyramid Lake and with surface runoff from nearby drainages. Therefore, planned pumping at Fish Springs Ranch would not be expected to have an effect on these wetlands because they do not depend on groundwater for their maintenance.

4.5.1.3 Conclusions

Direct impacts to wetlands would occur during construction of the pipelines. This activity would affect 1.4 acres of wetlands on private land. Because these wetlands would be rehabilitated, impacts would be short-term and minor.

Indirect impacts to wetlands would be significant and adverse. The water supply for 58 acres of wetlands on private land at Fish Springs Ranch would be eliminated. The water supply to 32 acres of wetlands on private land at Little Fish Springs in Honey Lake Valley would be reduced. The water supply to 195 acres of wetlands on mostly private land in the southwestern Smoke Creek Desert could also be reduced.

Population growth would result in the modification of some wetlands habitat in Spanish Springs Valley to residential and commercial developments. At full capacity, the *Truckee Meadows Project* would generate about 6,100 acre-ft/yr of treated wastewater. Some or all of this wastewater could be used for wetlands enhancement in the valley.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed

rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

The additional people would require about 200 acres of land in Lemmon Valley and about 8,700 acres in Spanish Springs Valley for residential and commercial developments.

Lemmon Valley

Wetlands in Lemmon Valley consist of small areas of wet meadows and emergent vegetation along the edge of Lemmon playa associated with the disposal of treated wastewater. Lemmon playa is not vegetated and is not considered a wetland. Policies established in the North Valleys Area Plan (Washoe County, 1991b) require anyone proposing to disturb wetland areas to comply with all applicable federal and local wetland regulations. Moreover, the *Truckee Meadows Regional Plan* (Truckee Meadows Regional Planning Agency, 1991) establishes a goal of retaining all significant hydrologic resources. These include not only wetlands regulated by Section 404 of the Clean Water Act, but also stream environments, playas, spring-fed stands of riparian vegetation, and non-404 wetlands.

Of the 800 acre-ft/yr of water planned for delivery to Lemmon Valley, approximately 400 acre-ft/yr would be treated and disposed of as wastewater. This wastewater would be available to maintain and enhance the existing wetlands surrounding Lemmon playa, or used to develop new wetlands in the valley, or used to irrigate parks and golf courses. The point of final disposal of the treated wastewater is not known at this time.

Spanish Springs Valley

Spanish Springs Valley supports about 1,300 acres of wetlands on mostly private lands that are maintained by leakage and irrigation return flows associated with the Orr Ditch. As the valley is developed, some of these wetlands would be modified to accommodate residential and commercial developments (SEA et al., 1991). These modifications, however, would have to comply with all applicable federal and local wetland regulations (Washoe County, 1991a). Moreover, the *Truckee Meadows Regional Plan* (Truckee Meadows Regional Planning Agency, 1991) establishes a goal of retaining all significant hydrologic resources. These include not only wetlands regulated by Section 404 of the Clean Water Act, but also stream environments, playas, spring-fed stands of riparian vegetation, and non-404 wetlands.

Of the 12,200 acre-ft/yr of water planned for delivery to Spanish Springs Valley, 6,100 acre-ft/yr would be treated and disposed of as wastewater. The method, location, and point of final disposal of this wastewater are not known at this time. This wastewater would be available to maintain and enhance the existing wetlands, or used to develop new wetlands as the valley is developed, or used to irrigate parks and golf courses.

4.5.2 *Alternative Routes*

Indirect impacts in the water source area and in the delivery/use area from the selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. Briefly, the water supply for 58 acres of wetlands at Fish Springs Ranch would be eliminated and the water supply to an additional 32 acres of wetlands near the ranch would be reduced by planned groundwater pumping at Fish Springs Ranch. The water supply to wetlands at Bonham Ranch and other wetlands in the southern Smoke Creek Desert could be reduced by as much as 43 percent.

Population growth in Lemmon and Spanish Springs Valleys could result in the conversion of some wetlands to residential and commercial developments. Local and regional plans establish a policy that any development proposed within wetland areas must comply with all applicable federal and local wetland regulations and policies. Wastewater generated from the project would be available to maintain and enhance wetlands in Lemmon and Spanish Springs Valleys.

4.5.2.1 *Winnemucca Valley Route*

The Winnemucca Valley route would disturb a total of 4.6 acres of wetlands. The wetlands occur on private land along the route of the gas pipeline in Warm Springs Valley at Hay, Wilcox, and Cottonwood Creeks, and along the water and gas pipeline route in Winnemucca Valley at two forks of upper Dry Valley Creek. Wetlands that would be affected consist primarily of palustrine scrub/shrub and some palustrine emergent vegetation.

Pipeline construction would disturb wetland habitats as the pipelines are placed across stream channels. Rapid succession by native plant species would be expected in these areas due to their small size and relatively abundant supplies of moisture.

Standard operating procedures for construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing impacts to wetlands (see Section 2.1.6). Pipeline construction affecting wetlands on private lands, as well as on public lands, would also require the acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect wetlands habitat. These stipulations might include grading and reseeding the wetlands with appropriate plant species after construction is completed. Long-term impacts to wetlands and related habitats from construction along the Winnemucca Valley route would be expected to be negligible.

4.5.2.2 *Antelope Valley Route*

The Antelope Valley route would impact a total of 1.4 acres of wetlands on private land along the route of the gas pipeline in Warm Springs Valley at Hay, Wilcox, and Cottonwood Creeks. Wetlands affected consist primarily of palustrine scrub/shrub and some palustrine emergent vegetation.

Pipeline construction would disturb wetlands and related habitats as the pipelines are placed across stream channels. Rapid succession by native plant species would be expected in these areas due to their small size and relatively abundant supplies of moisture.

Standard operating procedures for construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing impacts to wetlands (see Section 2.1.6). Pipeline construction affecting wetlands on private lands, as well as on public lands, would also require the acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect wetlands habitat. These stipulations might include grading and reseeding the wetlands with appropriate plant species after construction is completed. Long-term impacts to wetlands and related habitats from construction along the Antelope Valley route would be expected to be negligible.

4.5.2.3 Red Rock Valley Route

The Red Rock Valley Route would impact a total of 13.6 acres of wetlands. The wetlands occur on private land along (1) the route of the gas pipeline in Warm Springs Valley at Hay, Wilcox, and Cottonwood Creeks, (2) along the water and gas pipeline route in Winnemucca Valley at two forks of upper Dry Valley Creek, and (3) along the water pipeline route at a two-mile segment in southern Red Rock Valley. Wetlands that would be affected consist primarily of palustrine scrub/shrub and some palustrine emergent vegetation.

Pipeline construction would disturb wetlands and related habitats as the pipelines are placed across stream channels. Rapid succession by native plant species would be expected in these areas due to their small size and relatively abundant supplies of moisture.

Standard operating procedures for construction of the water and gas pipelines on public lands prohibit changing the character or causing siltation of rivers and streams, thereby minimizing impacts to wetlands (see Section 2.1.6). Pipeline construction affecting wetlands on private lands, as well as on public lands, would also require the acquisition of a nationwide 404 permit from the U.S. Army Corps of Engineers pursuant to the Clean Water Act. Construction stipulations contained in the permit would help protect wetlands habitat. These stipulations might include grading and reseeding the wetlands with appropriate plant species after construction is completed. With the exception of the wetlands in Red Rock Valley discussed in the next paragraph, long-term impacts to wetlands and related habitats from construction along this route would be expected to be negligible.

The water pipeline would pass through a two-mile segment in southern Red Rock Valley that supports significant areas of palustrine emergent and palustrine open-water wetlands. Because of the confined nature of the valley in this area, the right-of-way would not be able to avoid these wetlands. Construction of the water pipeline along this route would impact nine acres of wetlands. Washoe County would probably need an individual 404 permit from the U.S. Army Corps of Engineers for construction in this area. Construction stipulations contained in the permit would help protect these wetlands, but adverse effects from dredge

and fill operations, sediment loading, and accidental spills of oil, fuel, or hydraulic fluid could still occur which would adversely affect the water quality of these wetlands.

4.5.3 *No Action Alternative*

Under no action, the rights-of-way would be denied. No impacts would occur to wetlands and related habitats along the pipeline routes. Impacts to wetlands in Honey Lake Valley would not occur because irrigation at Fish Springs Ranch would continue at the approximate current rate of 5,900 acre-ft/yr. The owners of Fish Springs Ranch would retain the rights to approximately 14,000 acre-ft of water, some portion of which would presumably be put to beneficial use. The impacts to wetlands from the use of this water are unknown.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.5.3.1 *Supply Side Sub-Alternative*

Additional groundwater pumping in the Truckee Meadows would have unknown impacts to wetlands and related habitats because the locations of the four new wells to be pumped under this sub-alternative are not known.

The population in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows would grow by 35,400 people between 1995 to 2015. These people would require about 4,300 acres of land for residential and commercial developments. This land requirement, plus the continued acquisition of Truckee River irrigation water rights, could require modifications of some wetlands and the conversions of some irrigated lands to commercial and residential uses. Policies in the North Valleys Area Plan (Washoe County, 1991b), the Spanish Springs Valley Area Plan (Washoe County, 1991a), and in the *Truckee Meadows Regional Plan* (Truckee Meadows Regional Planning Agency, 1991) establish a goal of retaining all significant hydrologic resources in the region. These include not only wetlands regulated by Section 404 of the Clean Water Act, but also stream environments, playas, spring-fed stands of riparian vegetation, and non-404 wetlands. Also, a 404 permit issued by the U.S. Army Corps of Engineers pursuant to the Clean Water Act would be required for any dredge and fill operations that affect wetlands under the jurisdiction of the Corps.

Almost 1,800 acre-ft/yr of wastewater would be generated in Lemmon and Spanish Springs Valleys under this sub-alternative. This wastewater could be disposed of in Lemmon and Spanish Springs Valleys or sewerage back to the Truckee Meadows for treatment and disposal in the river. If the wastewater was treated in Lemmon and Spanish Springs Valley, it would be available to maintain and enhance existing wetlands in these valleys or used to create new wetlands. The point of final disposal of the treated wastewater is not known at this time. Wastewater generated in the Truckee Meadows would likely be treated at the

Truckee Meadows Water Reclamation Facility and released to the river. Impacts to wetlands from wastewater discharges to the river would be negligible.

4.5.3.2 Demand Side Sub-Alternative

Water conservation in the Reno-Sparks metropolitan area would have a small benefit to wetlands in the area simply because less water would be used for municipal and industrial purposes. Water quality of the Truckee River and its associated wetlands would also improve somewhat because less wastewater would be treated and released to the river.

4.5.3.3 Negotiated Settlement Sub-Alternative

Section 206 of the Negotiated Settlement Act authorizes and directs the Secretary of the Interior to acquire water rights to sustain 25,000 acres of wetlands in Lahontan Valley east of Fallon, Nevada. The U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation are currently preparing an EIS on the negotiated settlement to be released in the mid-1990s.

The population in Lemmon Valley, Spanish Springs Valley, and in the Truckee Meadows would grow by 139,300 people between 1995 to 2015. These people would require about 16,300 acres of land for residential and commercial developments. This land requirement would result in the gradual loss of irrigated lands and some modifications of wetlands habitat in the metropolitan area. Policies in the North Valleys Area Plan (Washoe County, 1991b), the Spanish Springs Valley Area Plan (Washoe County, 1991a), and in the *Truckee Meadows Regional Plan* (Truckee Meadows Regional Planning Agency, 1991) establish a goal of retaining all significant hydrologic resources in the region. These include not only wetlands regulated by Section 404 of the Clean Water Act, but also stream environments, playas, spring-fed stands of riparian vegetation, and non-404 wetlands. Also, a 404 permit issued by the U.S. Army Corps of Engineers pursuant to the Clean Water Act would be required for any dredge and fill operations that affect wetlands under the jurisdiction of the Corps.

About 6,500 acre-ft/yr of wastewater would be generated in Lemmon and Spanish Springs Valleys under this sub-alterative. This wastewater could be disposed of in Lemmon and Spanish Springs Valleys or sewered back to the Truckee Meadows for treatment and disposal in the river. If the wastewater was treated in Lemmon and Spanish Springs Valley, it would be available to maintain and enhance existing wetlands in these valleys or used to create new wetlands. The point of final disposal of the treated wastewater is not known at this time. The large volume of wastewater generated in the Truckee Meadows would likely be treated at the Truckee Meadows Water Reclamation Facility and released to the river. Impacts to wetlands from wastewater discharges to the river would be negligible.

4.6 *VEGETATION*

4.6.1 *Proposed Action*

4.6.1.1 *Direct Impacts*

Direct impacts to vegetation would occur from removal of vegetative cover during construction of the pipelines and the water storage tanks. Figure 3.6-1 shows the proposed routes of the water and gas pipelines and the vegetation communities along these routes. Table 4.6-1 summarizes the estimated disturbances within each of these vegetation communities from pipeline construction.

Six hundred acres of the big sagebrush vegetation community would be disturbed during pipeline construction. About 510 acres of this disturbance would be reclaimed immediately after construction; the disturbance would therefore represent a short-term loss of this vegetation cover. The balance of 90 acres would remain disturbed for the life of the pipeline for an access road. About 160 acres of low sagebrush vegetation would be disturbed; 137 acres would be reclaimed after construction and 24 acres would remain as a long-term loss devoted to the access road. About 160 acres of salt desert shrub vegetation would be disturbed during pipeline construction; 137 acres would be reclaimed, and the remaining 23 acres would be devoted to the access road, which would represent a long-term loss of cover.

Disturbance of communities containing antelope bitterbrush is specifically noted because of the importance of bitterbrush as big-game browse. About 215 acres of the affected sagebrush communities contain antelope bitterbrush. Of these, 185 acres would be reclaimed after construction; 30 acres would be devoted to the access road.

In summary, a total of 921 acres within the sagebrush and salt desert shrub communities would be disturbed by construction of the pipelines and water-storage facilities. Of this total, 784 acres would be reclaimed after construction, representing a short-term loss of native vegetation cover. The remaining 140 acres would be occupied by the 15-foot-wide access road, which would represent a long-term loss of vegetation cover.

In upper Warm Springs Valley, the gas pipeline would cross stretches of private land in Hay, Wilcox, and Cottonwood Creeks where perennial flow supports narrow strips of riparian and wetlands vegetation. The riparian vegetation at these crossings consists of shrubs such as willows, wild rose and basin big sagebrush, and several species of forbs and grasses. Pipeline construction would impact a 100-foot-wide corridor across these channels, which would disturb about 1.4 acres of riparian/wetland vegetation. Because the areas to be disturbed are narrow, rapid re-invasion of riparian vegetation from nearby undisturbed riparian habitat would be expected. Construction in these areas would require issuance of a 404 permit from the U.S. Army Corps of Engineers. Stipulations contained in the permit could also require additional measures to protect these riparian/wetland areas, beyond those proposed by the applicant.

TABLE 4.6-1

**DISTURBANCE TO VEGETATION COMMUNITIES FROM CONSTRUCTION OF PROPOSED
WATER AND GAS PIPELINES**

Vegetation Community	Short-Term^(a) Disturbance (in acres)	Long-Term^(b) Disturbance (in acres)
<u>Proposed Water Pipeline</u>		
Big Sagebrush	329	58
Low Sagebrush	63	11
Desert Salt Shrub ^(c)	84	14
Agricultural and Urban Lands	17	3
Antelope Bitterbrush Component ^(d)	(103)	(15)
Total Disturbance ^(e) --Water Pipeline	493	86
<u>Proposed Gas Pipeline</u>		
Big Sagebrush	180	32
Low Sagebrush	73	13
Desert Salt Shrub	53	9
Agricultural and Urban Lands	0	0
Antelope Bitterbrush Component	(82)	(15)
Total Disturbance--Gas Pipeline	306	54

^(a) The construction right-of-way would be 100 feet wide. Following completion of construction, about 85 feet of the disturbance would be reclaimed and seeded. The short-term disturbance acreage refers to the 85-foot width that would be reclaimed immediately after construction. Public and private lands are not distinguished.

^(b) The long-term disturbance refers to the approximate 15-foot-wide portion of the right-of-way that would remain unreclaimed during pipeline operation to provide access for inspection, maintenance and repair of the pipeline.

^(c) Desert Salt Shrub Communities include black greasewood vegetation communities, shadscale communities and mixed greasewood and shadscale communities.

^(d) Antelope Bitterbrush Component refers to the sagebrush communities along the pipeline routes within which antelope bitterbrush occurs as a significant sub-dominant or co-dominant shrub. Disturbance within bitterbrush areas is specifically distinguished because of bitterbrush's importance as big-game browse.

^(e) Although disturbance within bitterbrush areas is distinguished separately for purposes of evaluation, this disturbance is accounted for within the above disturbance acreages in sagebrush communities, as sagebrush is the dominant shrub. Therefore, the total disturbance is the sum of acres disturbed within the big sagebrush, low sagebrush, and desert salt scrub communities and agricultural and urban lands. The total disturbance for the water pipeline includes the disturbance associated with construction of the water-storage tanks.

The seed mixtures used to reclaim the right-of-way disturbances would be approved by BLM staff, and could include a variety of grasses, forbs, and shrubs that are adapted to the regional climate and site conditions. Livestock grazing and off-road vehicle use along some portions of the rights-of-way could adversely impact germination and revegetation success. If necessary, measures to temporarily exclude livestock and off-road-vehicles from some reclaimed areas would be developed in consultation with the BLM.

Reclamation should re-establish a productive vegetation cover within two to five years after construction. The re-established vegetation would not exactly duplicate the original vegetation cover, but invasion by plant species from the adjacent undisturbed lands would be expected. Over time, the diversity of the vegetative cover along the rights-of-way would become similar to adjacent native vegetation.

4.6.1.2 Indirect Impacts

- *Water Source Area*

Vegetation would be removed over several dozen acres of private land at Fish Springs Ranch for well-sites, the pumping station, the telemetry station and other ancillary facilities. The disturbed acreage would represent a long-term loss of vegetation.

Projected drawdown of the groundwater table from planned pumping at Fish Springs Ranch by Washoe County (Section 4.4) could affect phreatophytic plants over a broad part of eastern Honey Lake Valley. Drawdown of the water table would occur gradually reaching a maximum 100 years after pumping begins in 1995.

Phreatophytic Salt Desert Shrub Communities

Black greasewood is the phreatophytic species of most concern because of its prevalence over much of eastern Honey Lake Valley (Section 3.6.2). There are no published studies that have directly measured the effects on black greasewood over time from long-term lowering of the groundwater table. However, the results of recent investigations in Owens Valley suggest that drawdown of the water table beyond the reach of greasewood and other phreatophytic shrubs would cause death (Groeneveld et al, 1986a; 1986b). Black greasewood's association with areas of relatively shallow groundwater and its use of groundwater is well reported in the literature (White, 1932; Shantz and Piemeisel, 1940; Billings, 1949; Fautin, 1946; Robinson, 1958 and 1970; Branson et al, 1967 and 1976). Based on this body of evidence, as well as little or no evidence to the contrary, it is assumed that the projected lowering of the groundwater table in Honey Lake Valley would adversely affect black greasewood.

Quantification of indirect impacts to vegetation communities requires that an *extinction depth* be determined. The *extinction depth* is the depth to a dropping groundwater table beyond which plants that rely on groundwater can no longer survive. Greasewood and other shrubby phreatophytes obtain water from the moist capillary zone above the groundwater table. The extinction depth for such plants is determined by the depth to which deep roots

can no longer penetrate to the capillary zone because the groundwater table is too deep. In the fine-textured soils in Honey Lake Valley, the capillary zone can extend 15 feet above the groundwater table (Fetter, 1980). Where groundwater is relatively shallow, say less than 10 feet, the deep roots of greasewood are correspondingly shallow. Where groundwater is deeper than 20 feet, greasewood roots have been documented to extend an average of 20 feet from the surface (White, 1932; Robinson, 1958; Branson et al, 1967; Robertson, 1983; Groeneveld, 1986). Based on this evidence, an extinction depth of 35 feet is assumed for black greasewood in the fine-textured soils of Honey Lake Valley.

Black greasewood occurs in relatively pure stands in eastern Honey Lake Valley where the groundwater table is 10 and 25 feet below the surface. It also occurs as a co-dominant within two vegetation communities where the depth to groundwater is 35 to 40 feet. Therefore, the extinction depth of 35 feet for black greasewood is probably conservative and tends to overestimate the acreage of vegetation affected by drawdown.

Based on information in the literature for other phreatophytic species, a 35-foot extinction depth is also assumed for rabbitbrush, which is a sub-dominant in some portions of the black greasewood communities, and for basin wildrye, which is a sub-dominant in the black greasewood-basin big sagebrush-basin wildrye community. Based on their shallower root systems, an extinction depth of 25 feet is assumed for saltgrass, pickleweed, and seepweed, which are part of the desert sink vegetation type (Robinson, 1958; White, 1932).

Maximum drawdown of the groundwater table would occur gradually over a period of 100 years (Section 4.4). Figure 4.6-1 outlines the area in eastern Honey Lake Valley where the maximum depth to groundwater is projected to be greater than the 35-foot extinction depth. Within this area, greasewood and other phreatophytes would experience water stress when the depth to groundwater falls below the extinction depth. The majority of plants so affected can be expected to eventually die. Four vegetation communities that contain black greasewood and other phreatophytes occur in the area where the maximum depth to groundwater would fall below the 35-foot extinction depth (Figure 4.6-1). The impacts to each of these communities is discussed below.

Black Greasewood Community: Almost the entire shrub cover in this vegetation community is composed of black greasewood. Approximately 13,000 acres of this community occur where the maximum depth to groundwater is projected to be greater than the 35-foot extinction depth (Figure 4.6-1). For reasons discussed below, it is not clear if all black greasewood would be lost from this community. Based on the literature, however, it is concluded that the majority of individual greasewood plants would be eliminated. Because black greasewood is the sole dominant shrub in this community, shrub cover could be substantially reduced over 13,000 acres. This represents a substantial majority of the black greasewood vegetation in Honey Lake Valley.

Maximum drawdown is projected to take 100 years. Black greasewood is extremely drought tolerant and probably preferentially uses soil moisture derived from precipitation (White, 1932, Robinson, 1958; Groeneveld, 1986). In favorable precipitation years, individual plants deprived of moisture from groundwater may be capable of surviving on moisture from precipitation alone. Greasewood is deciduous and responds to water stress by progressively

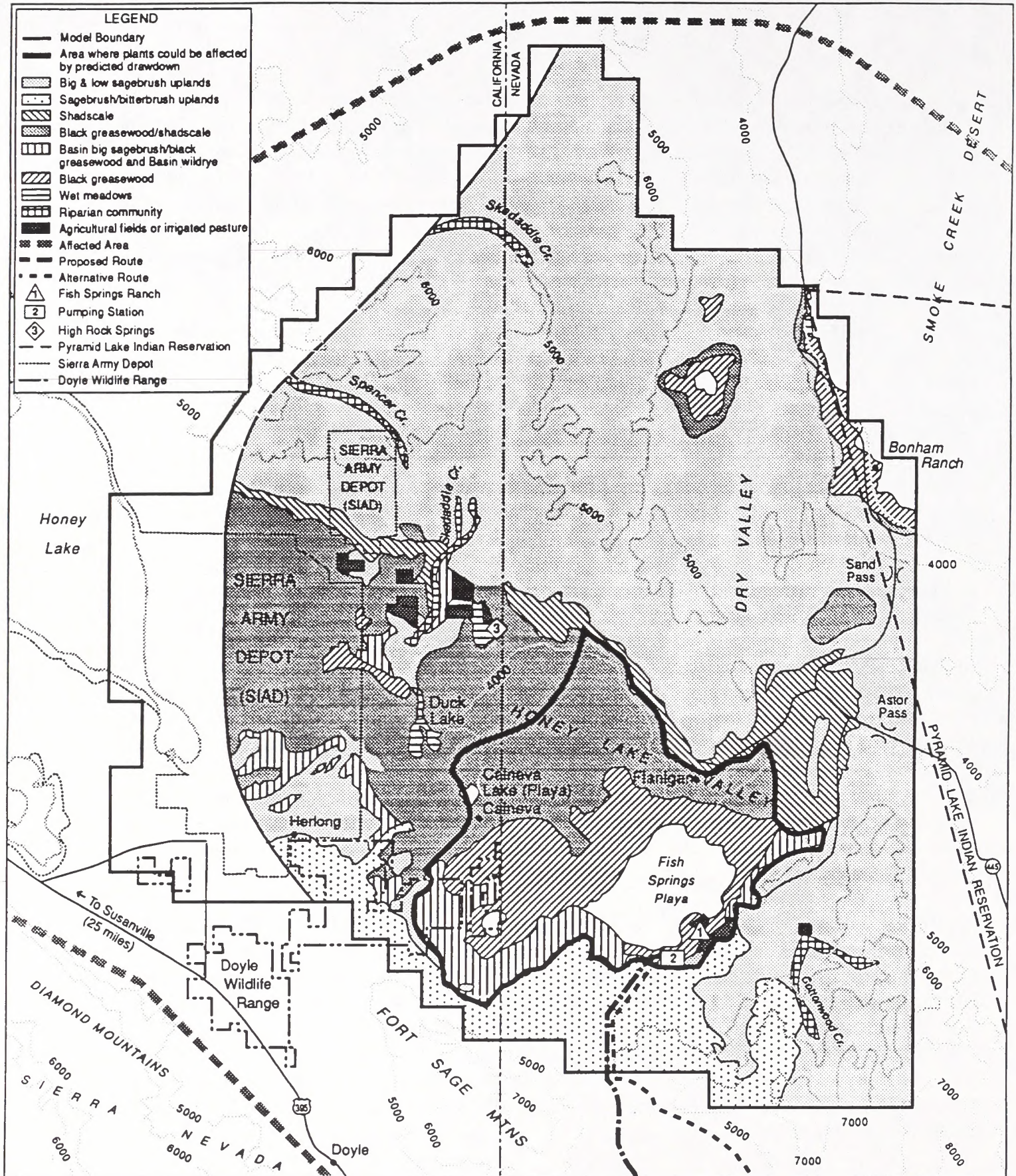
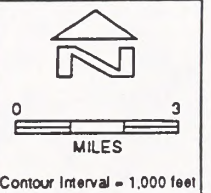


Figure 4.6-1

Area where Plants could be Affected by Projected Drawdown of the Groundwater Table



decreasing leaf area and finally entering early seasonal dormancy (Groeneveld et al, 1986b). Death of mature individuals could occur following a series of drought years in conjunction with the stress caused by a lowered groundwater table.

It is not clear whether drawdown of the water table would eventually eliminate all individuals of black greasewood from impacted parts of the community. Black greasewood has been demonstrated to reproduce primarily by root sprouting (Robertson, 1983). Although black greasewood could experience a die back of above-ground tissue during severe drought years, it may respond by root sprouting during favorable precipitation years. Recent studies in the Owens Valley have also shown that depletion of soil moisture in the rooting zone supporting greasewood plants was lower around widely spaced individuals than around more closely spaced individuals (Groeneveld et al, 1986b). This was attributed in part to the fact that widely spaced plants had access to a greater volume of soil and thus to more soil water from precipitation. It was also demonstrated that individual shrubs were capable of expanding their shallow lateral root systems up to 30 feet in response to clearing of adjacent vegetation, enabling them to more efficiently use shallow soil moisture from precipitation. It is therefore possible that, as individual greasewood plants in the affected area succumb to water stress from lowering of the groundwater table, the survival of neighboring individuals would be improved.

If a substantial loss of black greasewood from the 13,000 impacted acres in Honey Lake Valley occurs, some colonization of the community by non-phreatophytic shrubs could occur. Shadscale is the most likely native shrub to colonize the area. It occurs as a co-dominant with greasewood in a broad transition zone between the upper shadscale and lower greasewood communities. Several factors could be attributable to the current lack of shadscale in the black greasewood community. These include competition with greasewood, the existing shallow groundwater table, the elevated salinity and alkalinity of the soil, or a combination of these factors. Greasewood is more salt tolerant than shadscale (Shantz and Piemeisel, 1949; Gates et al, 1956; Branson et al, 1967). There is a general consensus that shadscale occurs in areas where the upper one to two feet of soil is only moderately saline, but can tolerate elevated salinity and alkalinity in the lower profiles (Flowers and Evans, 1966; West and Ibrahim, 1967).

As the density of black greasewood within the affected community is reduced, shadscale could colonize areas where the groundwater table is lowered and the upper one to two feet of soil is only moderately saline. Black greasewood has been demonstrated to increase soil salinity beneath its canopy by annual shedding of its leaves, which accumulate sodium (Rickard, 1965). As greasewood individuals are gradually eliminated over 100 years, the salinity of the upper soil profile could slowly become less saline due to leaching by precipitation, thereby allowing colonization by shadscale. In areas where no colonization occurs, annual and perennial grasses and forbs would likely become established. These annual species are able to establish and complete their life cycles during the spring and early summer when there is sufficient moisture available in the upper soil profile to promote growth and dilute salts in the soil water. Although it is difficult to predict the ultimate composition of the community that would result over the 13,000 affected acres of the existing black greasewood community in eastern Honey Lake Valley, it is likely that shrub cover would be less. This would be a significant, indirect impact of the proposed action.

A black greasewood community also occurs in the southern Smoke Creek Desert. Groundwater in this area is under *artesian* pressure. If it was not confined by relatively impermeable strata, the water table would rise above the land surface (see Section 4.4 for details). The *artesian* elevation of the groundwater table at Bonham Ranch is 37 feet above the land surface. Planned pumping at Fish Springs Ranch is projected to lower the *artesian* elevation throughout the modeled portion of the southwestern Smoke Creek Desert by 28 feet, but the *artesian* elevation of the water table would still be nine feet above the land surface. The *actual elevation* of the water table below the land surface would remain unchanged. Therefore, no impacts to greasewood communities would be expected in the Smoke Creek Desert.

Desert-sink Vegetation: Desert-sink vegetation occurs in narrow, 200-foot-wide bands around the perimeter of playas within the black greasewood community. Approximately 250 acres of desert sink vegetation would be affected by drawdown below the assumed 25-foot extinction depth for this vegetation type. Because species within this vegetation type are phreatophytes, the projected drawdown would result in a complete loss of all vegetation within this narrow band. The species that compose the desert sink vegetation are among the most salt tolerant plants. Therefore, no other species would be likely to colonize this area. The result would be an expansion of the existing barren playas.

Black Greasewood-Shadscale Community: This community occurs in a broad transition zone between the black greasewood community and the shadscale community in Honey Lake Valley. Impacts to this community from drawdown below the 35-foot extinction depth for greasewood would be different than the impacts to pure stands of greasewood because a large portion of the shrubs in this community, including shadscale, spiny hopsage, and budsage, do not require groundwater and would thus not be impacted by drawdown of the water table. From Figure 4.6-1, about 18,250 acres of the black greasewood-shadscale community in eastern Honey Lake Valley could be affected by drawdown of the groundwater table below the 35-foot extinction depth. It is assumed that a substantial percentage of the black greasewood in this area would be eliminated over 100 or more years. Seedlings of non-phreatophytic shrub species could become established in areas left vacant by the elimination of black greasewood from the community. Hence, the 18,250 acres of greasewood-shadscale community could gradually be converted to a shadscale community. Although the loss of black greasewood would cause a permanent change in the characteristics of the community, it would not result in a significant loss of shrub cover. The affected area represents one-fifth of the mixed greasewood-shadscale community in Honey Lake Valley.

Black Greasewood-Basin Big Sagebrush-Basin Wildrye Community: Within the black greasewood-basin big sagebrush-basin wildrye community, the shrub canopy consists of a mixture of phreatophytic black greasewood and rabbitbrush and one non-phreatophyte--basin big sagebrush. Basin wildrye is a phreatophyte. About 4,200 acres of the black greasewood-basin big sagebrush-basin wildrye community would be impacted by projected drawdown of the groundwater table below the 35-foot extinct depth. The total affected area is less than one-third of the total acreage of this community within Honey Lake Valley. Within the affected area, black greasewood and basin wildrye would be substantially reduced. Big sagebrush would not be eliminated from this area. However, it could have reduced vigor

and productivity because it may partially utilize groundwater, but it does not depend upon it. Therefore, the shrub cover within the community could be reduced. Basin wildrye could be reduced in the grass component.

The projected impacts to this community are less certain compared to other vegetation communities because evidence exists that this community may derive a large amount of its moisture from surface infiltration, or infiltration from the coarse sands in the foothills above it (SCS Technical Guide IIE, no date). This source of moisture would not be affected by drawdown of the regional groundwater table. Therefore, it is possible that the projected adverse impacts to this community either would not occur or would occur over a smaller area.

Riparian and Wet Meadow Vegetation on the Basin Floors

Phreatophytic riparian vegetation on the valley floor is limited to lower Skedaddle Creek and along irrigation ditches near High Rock Ranch. The riparian community along the creek is supported by infiltration of streamflow and would not be affected by drawdown of the regional groundwater table. The riparian community along the irrigation ditches is supported by infiltration of irrigation waters from the ditch. Drawdown from pumping at Fish Springs is not projected to affect the availability of water for irrigation at High Rock Spring (Section 4.4). Therefore, the riparian habitat and wetlands at High Rock Spring would not be affected.

Drawdown of the regional groundwater table in eastern Honey Lake Valley would not affect the seasonal wet meadows and wetlands at Duck Lake or the open water habitat of the playa at Calneva Lake, both of which are supported by surface runoff.

Approximately 258 acres of wet meadows and wetlands exist at Fish Springs Ranch. They are supported primarily by irrigation of adjacent pastures, but may also be supported by near-surface groundwater flow associated with Fish Springs. Planned pumping would lower the water table in this area by a maximum of 78 feet. All irrigation at the ranch would also cease upon commencement of pumping for the project. This would eliminate the water source for the wet meadows and wetlands at the ranch. Washoe County would purchase 442 acre/ft of existing water rights on Cottonwood Creek located a few miles east of the ranch. These water rights are currently used for alfalfa production near the creek. The 442 acre-ft/yr would be transported via pipes and ditches to the 200-acre wetland at the ranch. Livestock would be excluded from this wetland. The remaining 58 acres of wetlands at the ranch would be lost. An undetermined part of the 32-acre wet meadow at Little Fish Springs about a mile northeast of the ranch could also be adversely affected by potential reductions in spring flow.

About 195 acres of wetlands occur in the southwestern Smoke Creek Desert at Bonham Ranch, Rotten Egg Spring, Laird Springs, Buckbrush Springs, Soda Springs, and at several other isolated springs and seeps. Planned pumping at Fish Springs could reduce the discharge of the wells and springs supporting these wetlands by as much as 43 percent. This would have a significant adverse impact on the wetlands in this area, but it is not possible to quantify the reduction in wetlands acreage that could occur. Affected areas could be

colonized by shadscale and associated salt desert shrubs that do not rely on groundwater. These areas could be converted from wetlands and wet meadows to salt desert shrub communities.

Summary

Table 4.6-2 estimates the acreage that could be affected within each vegetation community from projected drawdown over 100 years. The majority of black greasewood on 13,000 acres in Honey Lake Valley could be eliminated, resulting in a major reduction of shrub cover. Part of the affected black greasewood community could be re-colonized by non-phreatophytic shrubs from the nearby shadscale vegetation communities. The balance of the affected area would be expected to change through succession to a cover of annual and perennial grasses and forbs.

TABLE 4.6-2 AFFECTED ACREAGE WITHIN EACH OF THE VEGETATION COMMUNITIES CONTAINING PHREATOPHYTES IN THE WATER SOURCE AREA	
Vegetation Community	Affected Acres
Black Greasewood	13,000
Black Greasewood-Shadscale	18,250
Black Greasewood-Basin Big Sagebrush- Basin Wildrye	4,200
Desert Sink	250
Wet Meadows/Wetlands	not determined ^(a)
^(a) Potential loss of wet meadows/wetlands habitat could occur at Bonham Ranch, Buckbrush Springs, Laird Springs, and other wetlands in the Smoke Creek Desert. For reasons discussed in the text, there is insufficient information to quantify the potential loss (in acres) of this vegetation community in the Smoke Creek Desert. See Section 4.5 for additional information.	

About 18,250 acres of the greasewood-shadscale community and 4,200 acres of the black greasewood-basin big sagebrush-basin wildrye community could be affected by the loss of greasewood and other phreatophytes. This would reduce shrub density and diversity, and reduce total plant productivity in affected areas in these communities.

All phreatophytic vegetation could be lost from the 250 acres of desert sink vegetation that occurs in a narrow zone around playas in eastern Honey Lake Valley. Because of elevated salinity, these areas would likely remain un-colonized and the bare area of the playa would expand.

Fifty-eight acres of wetlands vegetation would be lost at Fish Springs Ranch, and some portion of the 32-acre wetland at Little Fish Springs could be affected. Wetlands at Bonham Ranch, Buckbrush Springs, Laird Springs, Rotten Egg Spring, Soda Springs and several other isolated springs and seeps along the southwestern edge of the Smoke Creek Desert could be reduced due to diminished discharge at flowing wells and springs. Affected areas could be colonized by shadscale and associated salt desert shrubs that do not rely on groundwater. These areas could be converted from wetlands and wet meadows to salt desert shrub communities. The acreage wetlands that could be affected is undetermined.

Uncertainties

Several uncertainties exist in predicting impacts to vegetation in the water source area from planned groundwater pumping. These uncertainties are relevant to a reasoned analysis of impacts. Among these are (1) uncertainties concerning the maximum vertical and lateral extent of drawdown projected by the groundwater flow model, (2) uncertainties associated with the assumed 35-foot extinction depth for major phreatophytic species, and (3) uncertainties concerning the response of black greasewood and other phreatophytes to gradual lowering of the groundwater table over 100 years.

For reasons discussed earlier, the 35-foot extinction depth for greasewood is considered conservative and may over-estimate potential adverse impacts. It is based in part on several studies that have recorded at least a 20-foot rooting depth for greasewood and other phreatophytic shrubs. However, some researchers have documented the deep roots of greasewood to reach 35 to 50 feet in the portions of its range where groundwater is correspondingly deep (Meinzer, 1927; Harr and Price, 1972; Romo, 1985; Robertson, 1983). Moreover, black greasewood is apparently surviving in isolated parts of Honey Lake Valley where the depth to groundwater is presently 35 to 40 feet. If the extinction depth for greasewood in Honey Lake Valley is closer to 50 feet, the acreage of greasewood communities affected would be about half that listed on Table 4.6-2.

Drawdown of the water table would occur gradually over 100 years after pumping begins. It is possible that existing greasewood plants could extend their deep root systems in response to a gradual lowering of groundwater. Rates of root elongation for grasses are reported to be about one-half inch per day (Russell, 1977). Although root elongation for shrubs such as black greasewood may be slower, it still could be considerably faster than the projected rate of water-table drawdown. Studies in the Owens Valley suggest that greasewood roots lengthen in response to lowering of the water table (Groeneveld et al, 1986). If it is reasonable to assume that greasewood in the affected area is capable of extending its roots to depths of approximately 50 feet, then the acreage of greasewood communities affected by drawdown would be approximately half that listed on Table 4.6-2.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

In Lemmon Valley an estimated 200 acres would be disturbed for residential and commercial developments. Based on maps of planned development in Lemmon Valley (Washoe County, 1991b), these disturbances would primarily affect salt desert shrub and northern desert shrub (big and low sagebrush) communities in equal amounts. The small wetlands in the vicinity of Lemmon playa are not suitable for future development based on soil characteristics and a near-surface water table (Washoe County, 1991b).

In Spanish Springs Valley an estimated 8,700 acres would be disturbed for residential and commercial developments. Based on the Spanish Springs Area Plan (Washoe County, 1991a), 2,000 acres of agricultural land and 3,500 acres of salt desert shrub and big sagebrush communities would be disturbed through the year 2007 for growth. If this same land-disturbance ratio held true for growth from 1995 through 2015, then approximately 3,170 acres of agricultural land and 5,500 acres of salt desert shrub and big sagebrush communities would be disturbed through 2015.

About 1,300 acres of riparian and wet meadow/wetland vegetation now occurs in Spanish Springs Valley. The Area Plan for Spanish Springs Valley states that a system of open space, in the form of greenbelts, would be developed along the floodplain and wetland areas to preserve the natural setting (Washoe County, 1991a). Some portion of the existing wetlands associated with irrigated areas would likely be eliminated by changes in irrigation practices alone, and possibly also by residential and commercial construction.

4.6.1.3 Threatened, Endangered and Rare Plant Species

As described in Section 3.6.4, no endangered, threatened or candidate plant species occur along the proposed pipeline rights-of-way, within the water source area, or within the delivery areas. Therefore, there would be no impacts to these species from pipeline construction, groundwater pumping in Honey Lake Valley, or from water delivery to Lemmon and Spanish Springs Valleys.

4.6.2 Alternative Routes

The vegetation types along the alternative pipeline segments are illustrated on Figure 3.6-1. Table 4.6-3 estimates the total disturbance within each vegetation community that would occur from construction of the water and gas pipelines along the three alternative routes and the proposed route. About 85 percent of the disturbance along each alternative route would be reclaimed immediately following construction and would thus represent a short-term loss of vegetation cover. About 15 percent of each route would be devoted to an access road during the life of the project and would thus represent a long-term loss of vegetative cover.

The indirect impacts that would occur to vegetation in the water source area, Lemmon Valley, and Spanish Springs Valley from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. Projected drawdown of the groundwater table could cause a substantial loss of greasewood over 13,000 acres in eastern Honey Lake Valley. Projected drawdown could also result in a substantial loss of greasewood from about 18,250 acres of the greasewood-shadscale community and 4,200 acres of the black greasewood-basin big sagebrush-basin wildrye community in Honey Lake Valley. Although this would not result in a complete loss of shrub cover, it would cause a permanent change in the shrub component in these two communities. Drawdown could also eliminate 250 acres of desert sink vegetation that grows along the fringes of playas in eastern Honey Lake Valley, as well reduce the water supply to 90 acres of wetland vegetation at and near Fish Springs Ranch. Reduction in subsurface groundwater flow from

TABLE 4.6-3

**DISTURBANCE TO VEGETATION COMMUNITIES
FROM PROPOSED AND ALTERNATIVE RIGHTS-OF-WAY**

Vegetation Community	Disturbance in Acres ^(a)			
	Bedell Flat (Proposed)	Redrock Valley Alt.	Antelope Valley Alt.	Winnemucca Valley Alt.
Big Sagebrush	598.6	856.4	663.6	620.4
Low Sagebrush	160	109	134	118
Salt Desert Shrub	160	170	150	155
Agricultural and Urban Land	20	40	10	30
Sagebrush/Bitterbrush Component ^(b)	(215)	(380)	(245)	(195)
Riparian and Wetland Vegetation ^(c)	1.4	13.6	1.4	4.6
Total Disturbance ^(d)	940	1,179	959	928

^(a) Total disturbance is based on a 100-foot-wide right-of-way for construction of both the water and gas pipelines. Of the initial disturbance, about 85 percent would be reclaimed immediately following construction and a 15-foot-wide access corridor would remain unreclaimed for the life of the project.

^(b) Sagebrush/Bitterbrush Component refers to the affected portions of the sagebrush communities that have antelope bitterbrush as an important sub-dominant shrub species.

^(c) Based on National Wetland Inventory maps.

^(d) The disturbance to areas containing antelope bitterbrush is specifically distinguished for purposes of evaluation; however, the disturbance within these areas is accounted for within the disturbance to the sagebrush communities within this column. Therefore, the total disturbance is the sum of disturbance to the big sagebrush, low sagebrush, and salt desert shrub communities and to agricultural and urban lands.

Honey Lake Valley to the southwestern Smoke Creek Desert could reduce the natural flow of wells and springs in the Smoke Creek Desert thereby affecting the acreage of wet meadows and wetlands in this area, particularly at Bonham Ranch.

Growth in Lemmon and Spanish Springs Valleys indirectly associated with the proposed rights-of-way would result in the removal of native vegetation and agricultural lands for residential and commercial development.

4.6.2.1 *Winnemucca Valley*

Construction along the Winnemucca Valley route would disturb a total of 928 acres of vegetation, of which 30 acres are agricultural and urban lands. Of the disturbance within the native vegetation communities, 760 acres would be reclaimed after construction, representing a short-term loss of native vegetative cover. The remaining 135 acres would be devoted to a 15-foot-wide access road, which would represent a long-term loss of vegetation cover.

Of this disturbance, about 620 acres would occur within big sagebrush vegetation communities and 115 acres would occur within low sagebrush vegetation communities. Of the sagebrush communities affected, 195 acres contain antelope bitterbrush as an important co-dominant shrub. A total of 155 acres of salt desert shrub vegetation would be disturbed. As discussed previously, 85 percent of the disturbance would be reclaimed immediately and thus 15 percent of the disturbance would represent a long-term loss of vegetation cover. The Winnemucca Valley route would cause a long-term loss of about 93 acres of big sagebrush cover and 17 acres of low sagebrush cover; of this, about 23 acres would be a long-term loss of antelope bitterbrush vegetation. About 23 acres of salt desert shrub vegetation cover would be lost for the long-term.

The water and gas pipelines for the Winnemucca Valley route would affect riparian and wetland vegetation on private lands at two forks of upper Dry Valley Creek. In Warm Springs Valley, the gas pipeline would cross stretches of private land in Hay, Wilcox, and Cottonwood Creeks where perennial flow supports narrow strips of riparian and wetlands vegetation. The riparian vegetation at these crossings consists of shrubs such as willows, wild rose and basin big sagebrush, and several species of forbs and grasses. Pipeline construction would impact a 100-foot-wide corridor across these channels, which would cumulatively disturb about 4.6 acres of riparian/wetland vegetation. Because the areas to be disturbed are narrow, rapid re-invasion of riparian vegetation from nearby undisturbed riparian habitat would be expected. Construction in these areas would require issuance of a 404 permit from the U.S. Army Corps of Engineers. Stipulations in this permit could also require additional measures to protect these riparian/wetland areas, beyond those proposed by the applicant.

The seed mixtures used to reclaim the right-of-way disturbances would be approved by BLM staff, and could include a variety of grasses, forbs, and shrubs that are adapted to the regional climate and site conditions. Livestock grazing and off-road vehicle use along some portions of the rights-of-way could adversely impact germination and revegetation success. If necessary, measures to temporarily exclude livestock and off-road-vehicles from some reclaimed areas would be developed in consultation with the BLM.

Reclamation should re-establish a productive vegetation cover within two to five years after construction. The re-established vegetation would not exactly duplicate the original vegetation cover, but invasion by plant species from the adjacent undisturbed lands would be expected. Over time, the diversity of the vegetative cover along the rights-of-way would become similar to adjacent native vegetation.

4.6.2.2 Antelope Valley

Construction along the Antelope Valley route would disturb 959 acres of vegetation, of which about 10 acres are agricultural and urban lands. Of the disturbance within the native vegetation communities, 790 acres would be reclaimed immediately following construction, representing a short-term loss of native vegetative cover. The remaining 135 acres would be occupied by the 15-foot-wide access road, which would represent a long-term loss of vegetation cover.

Of the disturbance to vegetation communities from construction of the water and gas pipelines along this route, a total of 664 acres would occur within big sagebrush vegetation communities and 134 acres would occur within low sagebrush vegetation communities. Of the sagebrush communities affected, 245 acres contain antelope bitterbrush as an important co-dominant shrub. A total of 150 acres of salt desert shrub vegetation would be disturbed. The Antelope Valley route would cause a long-term loss of about 98 acres of big sagebrush cover and 20 acres of low sagebrush cover; of this, about 37 acres would also represent a long-term loss of antelope bitterbrush vegetation. About 22 acres of salt desert shrub vegetation cover would be lost for the long-term.

In upper Warm Springs Valley, the gas pipeline would cross stretches of private land in Hay, Wilcox, and Cottonwood Creeks where perennial flow supports narrow strips of riparian and wetlands vegetation. The riparian vegetation at these crossings consists of shrubs such as willows, wild rose and basin big sagebrush, and several species of forbs and grasses. Pipeline construction would impact a 100-foot-wide corridor across these channels, which would disturb about 1.4 acres of riparian/wetland vegetation. Because the areas to be disturbed are narrow, rapid re-invasion of riparian vegetation from nearby undisturbed riparian habitat would be expected. Construction in these areas would require issuance of a 404 permit from the U.S. Army Corps of Engineers. Stipulations contained in the permit could also require additional measures to protect these riparian/wetland areas, beyond those proposed by the applicant.

The seed mixtures used to reclaim the right-of-way disturbances would be approved by BLM staff, and could include a variety of grasses, forbs, and shrubs that are adapted to the regional climate and site conditions. Livestock grazing and off-road vehicle use along some portions of the rights-of-way could adversely impact germination and revegetation success. If necessary, measures to temporarily exclude livestock and off-road-vehicles from some reclaimed areas would be developed in consultation with the BLM.

Reclamation should re-establish a productive vegetation cover within two to five years after construction. The re-established vegetation would not exactly duplicate the original vegetation cover, but invasion by plant species from the adjacent undisturbed lands would be expected. Over time, the diversity of the vegetative cover along the rights-of-way would become similar to adjacent native vegetation.

4.6.2.3 *Red Rock Valley*

Construction of the water and gas pipelines along the Red Rock Valley route would disturb 1,179 acres of vegetation, of which about 40 acres are agricultural and urban lands. Of the disturbance to native vegetation communities, about 970 acres would be reclaimed after construction, representing a short-term loss of native vegetative cover. The remaining 170 acres would be occupied by a 15-foot-wide maintenance road, which would represent a long-term loss of vegetation cover.

Of this disturbance, 854 acres would be in big sagebrush vegetation communities and 109 acres would be in low sagebrush vegetation communities. Of the sagebrush communities

affected, 380 acres contain antelope bitterbrush as an important co-dominant shrub. A total of 170 acres of salt desert shrub vegetation would be disturbed. The Red Rock Valley route would thus result in a long-term loss of about 126 acres of big sagebrush cover and 16 acres of low sagebrush cover; of this, about 57 acres would also represent a long-term loss of antelope bitterbrush vegetation. About 25 acres of salt desert shrub vegetation cover would be lost for the long-term.

Several areas of wetlands and riparian vegetation occur on private lands along the Red Rock Valley route. Construction of the water pipeline through Red Rock Valley would affect approximately 9.0 acres of wetlands/riparian vegetation. An additional 4.6 acres of wetlands and riparian vegetation would be affected in upper Dry Valley Creek (Winnemucca Valley) and at Hay, Wilcox, and Cottonwood Creeks in Warm Springs Valley. The riparian vegetation at these crossings consists of shrubs such as willows, wild rose and basin big sagebrush, and several species of forbs and grasses. Pipeline construction would impact a 100-foot-wide corridor across these channels. Because the areas to be disturbed are narrow, rapid re-invasion of riparian vegetation from nearby undisturbed riparian habitat would be expected. Construction in these areas would require issuance of a 404 permit from the U.S. Army Corps of Engineers. Stipulations contained in the permit could also require additional measures to protect these riparian/wetland areas, beyond those proposed by the applicant.

The seed mixtures used to reclaim the right-of-way disturbances would be approved by BLM staff, and could include a variety of grasses, forbs, and shrubs that are adapted to the regional climate and site conditions. Livestock grazing and off-road vehicle use along some portions of the rights-of-way could adversely impact germination and revegetation success. If necessary, measures to temporarily exclude livestock and off-road-vehicles from some reclaimed areas would be developed in consultation with the BLM.

Reclamation should re-establish a productive vegetation cover within two to five years after construction. The re-established vegetation would not exactly duplicate the original vegetation cover, but invasion by plant species from the adjacent undisturbed lands would be expected. Over time, the diversity of the vegetative cover along the rights-of-way would become similar to adjacent native vegetation.

4.6.3 *No Action Alternative*

Under no action, the rights-of-way would be denied. No impacts would occur to vegetation along the pipeline routes or in Honey Lake Valley. The owners of Fish Springs Ranch would retain the rights to approximately 14,000 acre-ft of water, some portion of which would presumably be put to beneficial use. The impacts to vegetation from the use of this water are unknown.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.6.3.1 Supply Side Sub-Alternative

By 2015, an additional 100 acres in Lemmon Valley would be disturbed for 800 new residents under this sub-alternative. The majority of this development would probably impact salt desert shrub and sagebrush communities.

By 2015, about 2,400 acres in Spanish Springs Valley would be disturbed for 11,900 new residents. Based on the Spanish Springs Area Plan (Washoe County, 1991a), 2,000 acres of agricultural land and 3,500 acres of salt desert shrub and big sagebrush communities would be disturbed through the year 2007 for forecasted growth. If this same land-disturbance ratio held true for growth from 1995 through 2015, then approximately 880 acres of agricultural land and 1,500 acres of salt desert shrub and big sagebrush communities would be disturbed through 2015.

From 1995 to 2015, the supply side sub-alternative would support 22,700 additional people in the Truckee Meadows that would require about 1,800 acres for residential and commercial developments. Some of this land would likely be agricultural and pasture land. Disturbance to native vegetation communities would occur primarily to big and low sagebrush communities, with a smaller amount affecting salt desert shrub communities. Development in the western Truckee Meadows could also impact sagebrush/juniper communities in the foothills of the Sierra Nevada. Development in the Truckee Meadows could impact areas of wet meadows.

Groundwater pumping associated with this sub-alternative could lower the groundwater table in localized areas in the Truckee Meadows, thereby affecting vegetation that is maintained by near-surface groundwater. Specific impacts to vegetation from this pumping cannot be assessed because the locations of the four new wells associated with this sub-alternative are not known.

The supply side sub-alternative includes the conversion of Truckee River irrigation rights to municipal and industrial uses. This would reduce the acreage of irrigated pasture and hay lands in the area. Reductions in irrigation could also result in the loss of wet meadow/wetland habitat, particularly in the Truckee Meadows and in Spanish Springs Valley where this habitat is maintained by seepage from irrigation ditches. These land conversions, however, must comply with federal wetland regulations, as well as regional and local wetlands policies.

4.6.3.2 Demand Side Sub-Alternative

Xeriscaping would promote the use of drought tolerant and naturalized plant species in the metropolitan area. These plants are able to survive severe droughts. In general, the metropolitan area would likely contain fewer exotic trees and shrubs than it does now.

4.6.3.3 Negotiated Settlement

In Lemmon Valley an estimated 200 acres would be disturbed for residential and commercial developments to support 2,900 new residents by 2015. Based on maps of planned development in Lemmon Valley (Washoe County, 1991b), these disturbances would primarily affect salt desert shrub and northern desert shrub (big and low sagebrush) communities in equal amounts. The small wetlands in the vicinity of Lemmon playa are not suitable for future development based on soil characteristics and a near-surface water table (Washoe County, 1991b).

In Spanish Springs Valley an estimated 8,700 acres would be disturbed for residential and commercial developments to support 43,600 new residents by 2015. Based on the Spanish Springs Area Plan (Washoe County, 1991a), 2,000 acres of agricultural land and 3,500 acres of salt desert shrub and big sagebrush communities would be disturbed through the year 2007 for growth. If this same land-disturbance ratio held true for growth from 1995 through 2015, then approximately 3,170 acres of agricultural land and 5,500 acres of salt desert shrub and big sagebrush communities would be disturbed through 2015.

About 1,300 acres of riparian and wet meadow/wetland vegetation now occurs in Spanish Springs Valley. The Area Plan for Spanish Springs Valley states that a system of open space, in the form of greenbelts, would be developed along the floodplain and wetland areas to preserve the natural setting (Washoe County, 1991a). Some portion of the existing wetlands associated with irrigated areas would likely be eliminated by changes in irrigation practices alone, and possibly also by residential and commercial construction. These land conversions, however, must comply with all applicable federal wetland regulations, as well as regional and local wetlands policies.

From 1995 to 2015, new residential and commercial developments in the Truckee Meadows would disturb 7,400 acres in support of 92,800 new residents using water from the negotiated settlement. Some of this land would likely be agricultural and pasture land. Disturbance to native vegetation communities would occur primarily to big and low sagebrush communities, with a lesser amount affecting salt desert shrub communities. Development in the western Truckee Meadows could also impact sagebrush/juniper communities in the foothills of the Sierra Nevada. Development in the Truckee Meadows could impact existing areas of wet meadows that are delineated as wetlands. These land conversions would have to comply with all applicable federal wetland regulations, as well as regional and local wetlands policies.

4.7 WILDLIFE

4.7.1 Proposed Action

4.7.1.1 Direct Impacts

Construction of the proposed pipelines would directly impact wildlife populations by (1) loss or displacement of individuals during construction, (2) increased human activity at

construction sites, and (3) loss or alteration of habitat from vegetation removal within the rights-of-way. The loss and displacement of individuals is temporary and would last for the duration of construction, which is expected to take nine months. Habitat loss would be short-term until vegetation cover is re-established in the disturbed areas. It could require two to three years to establish a substantial vegetation cover in the rights-of-way and another 10 to 15 years for shrub growth to approximate that of surrounding undisturbed habitats.

Direct impacts to wildlife species during pipeline construction would include mortality of individuals located within the rights-of-way. Small mammals and reptiles that inhabit burrows are the most likely to suffer mortality from vegetation removal and construction activities. Other more mobile small- and medium-sized animals and birds would be displaced from the rights-of-way during construction. With the exception of a few candidate species discussed below, the small mammals, reptiles, and birds that would be affected are common and abundant in the sagebrush and salt desert shrub habitats throughout the region. These species also have high reproductive rates. The loss of individuals due to pipeline construction is unlikely to adversely impact local populations of these affected species. Upon cessation of construction and re-establishment of a productive vegetative cover, individuals from the adjacent undisturbed habitats would recolonize the rights-of-way.

Pipeline construction would remove habitat during construction. Affected habitats would be reseeded with appropriate seed mixtures. The sagebrush and salt shrub habitat are common and abundant throughout the region and pipeline construction would remove only a very small percentage of the available habitat.

Loss of habitat within the rights-of-way would adversely impact small wildlife species with very limited home ranges such as mice and shrews. For these species, the clearing of the rights-of-way could represent a reduction in the carrying capacity of a substantial portion of their home range until a productive vegetation cover is re-established. Most of these species are common and abundant throughout the area and the loss of some individuals as a result of habitat removal would have an insignificant impact on populations of these species throughout the region. For larger, more mobile wildlife species, the rights-of-way would represent a very small part of their range, and individuals would not be substantially affected.

The route of the proposed gas pipeline would affect wetlands and riparian habitat on private land associated with perennial flow in Hay, Wilcox, and Cottonwood Creeks. A total of 1.4 acres of wetland and riparian habitat consisting primarily of shrubby willows, wildrose, various grasses, and emergent vegetation would be removed during construction of the gas pipeline at these creek crossings. During pipeline construction, flow in these creeks would be temporarily diverted away from the crossing, but would rejoin the streambed a short distance below the construction area. Impacts to fish and aquatic invertebrates should be minor and short term. Water quality during construction could be temporarily degraded by increased sediment loads during construction. The pipeline would be buried beneath the stream channel, well below expected scour depths, and therefore would not cause long-term impacts to water quality and associated aquatic life.

A body of information has emerged recently in the literature concerning habitat fragmentation. Much of this work has been on dense forests where clearing of vegetation for features such as transmission corridors has been shown to adversely affect several species of animals by reducing and altering habitat and increasing predation at the forest edges (Robbins, 1988; Wilcove et al., 1988). These impacts occur primarily because species adapted to dense forests cannot utilize the adjacent cleared habitats nor can they successfully cross them. The impacts are greatest when an area is traversed by a network of several clearings. Fragmentation impacts have not been demonstrated in shrub habitats in the arid southwest. Adverse impacts on shrub-adapted species from fragmentation resulting from construction of rights-of-way are not expected because:

- The cleared rights-of-way would be narrow; 100 feet is not a long distance to cross for rodents, reptiles, and birds.
- All but 15 feet of the rights-of-way would be revegetated with shrubs, forbs, and grass species. Although a mature shrub community would not be re-established on the rights-of-way for several years, there should be sufficient vegetation cover after two or three years that the rights-of-way would not represent a bare corridor for animals to traverse.
- The rights-of-way are linear, and large expanses of adjacent unaltered shrub habitat would remain.

Construction activities and the presence of humans would also result in the displacement of larger and more mobile wildlife species along discrete parts of the pipeline routes lasting for nine months. Six widely-separated construction crews would work along any given one-mile segment for no more than a few weeks. Therefore, disturbance and displacement of wildlife in the vicinity of each crew would be short-lived. Most wildlife species would not be adversely affected by the temporary disturbance and displacement. However, displacement of some species from areas used for important parts of their life cycle, such as breeding or brood-rearing areas, could have a greater impact. Potential impacts to wildlife such as raptors and sagegrouse are discussed in the following sections.

Construction could also indirectly impact wildlife by increased mortality from vehicles and by harassment. Such losses are not expected to significantly impact local populations because construction crews would be in any one area only for a few weeks and construction would last for only one season.

During operation, the pipelines would be inspected along an access road about once-a-month with the use of a 4-wheel-drive vehicle. The access road would increase accessibility by the public to previously unroaded areas. These areas include northern Dry Valley Creek, a small area between Seven Lakes Mountain and Dogskin Mountain, and the areas between upper Olinghouse Canyon to Hay Canyon across the Pah Rah Range. The Pah Rah Range is of particular concern because this area contains year-long mule deer range, a use area for sagegrouse, and habitat for the mountain quail which is a candidate species (Figures 3.7-1 and 3.7-2). Increased public access to these areas could increase hunting pressure, poaching, and harassment.

The following sections discuss potential impacts to game species and raptors along the proposed pipeline routes. Potential impacts to endangered, threatened, and candidate species are discussed in Section 4.7.1.4.

- *Mule Deer*

The proposed pipeline routes do not cross any areas of NDOW-identified critical mule deer habitat or BLM-identified crucial habitat (Figure 3.7-1). The route of the water pipeline approaches the eastern boundary of a BLM-identified crucial deer range in the Fort Sage Mountains (Figure 3.7-1). About 8.5 miles of the gas pipeline would cross mule deer summer and winter range in the Pah Rah Range, including a migration corridor between Wilcox and Hay Canyons (Figure 3.7-1). This would disturb about 100 acres of deer range. The new access created along the unroaded segment of the gas pipeline over the Pah Rah Range could increase hunting pressure on the deer population in that area.

Construction of the water and gas pipelines would disturb about 200 acres of sagebrush-bitterbrush habitat (Table 4.6-1); this habitat is important to wintering resident and interstate mule deer herds (Section 3.7.1). None of this disturbance would occur in critical or crucial winter range. Re-establishment of antelope bitterbrush in those parts of the affected area damaged by wildfire has been largely unsuccessful (BLM, 1988). Therefore, the loss of the bitterbrush from the pipeline rights-of-way would likely be long term. Because the width of the right-of-way would be only 100 feet, the loss of habitat would affect a small portion of the area used by deer along any given segment of the right-of-way. Therefore, impacts to populations of wintering mule deer would be minor.

Increased human presence and noise during construction would likely cause mule deer to avoid the immediate construction areas. Construction is expected to last nine months and would not extend into the winter, when deer would be most sensitive to these disturbances. Construction crews would be in a single area along the right-of-way for only a few weeks. The displacement of deer from these areas would therefore be temporary. For these reasons, construction activities and increased human presence should not significantly impact local populations of mule deer.

- *Pronghorn Antelope*

The route of the water pipeline crosses a pronghorn antelope use area in the vicinity of Dry Valley-Bedell Flat-Hungry Valley. This area is used by a herd of 75 to 100 animals. Construction would disturb about 250 acres of antelope habitat, which represents about 0.3 percent of the 90,000 acres of available antelope habitat in the use area. Portions of the gas pipeline would cross another pronghorn use area on the west side of the Pah Rah Range that encompasses about 24,000 acres. Construction of the gas pipeline would disturb about 90 acres of habitat within this area, which represents about 0.4 percent of the available antelope habitat in the use area. Based on the relatively small amount of habitat that would be impacted, pipeline construction should have minor impacts on pronghorn.

During construction, antelope would likely avoid the immediate construction areas. Because these areas represent a small percentage of the available habitat, and because periods of

construction activity along any given segment of the route would be for only a few weeks, disturbance from construction should have minor effects on pronghorn antelope.

- *Upland Game Birds*

The majority of the route of the water and gas pipelines provides limited habitat for California quail and chukars. Pipeline construction should have little impact on populations of these species.

The water pipeline would cross a sagegrouse use area in the Bedell Flat-Sand Hills area (Figure 3.7-2). Construction of the pipeline would remove about 30 acres of sagebrush vegetation in this area. This represents about 0.2 percent of the available sagebrush habitat in this use area. The gas pipeline would cross a sagegrouse use area in the Pah Rah Range. Construction of this segment of the pipeline would disturb about 60 acres of sagebrush habitat, which is about 0.3 percent of the available habitat in this use area. Considering the small percentage of habitat affected, these losses should not significantly affect the sagegrouse populations in these areas.

The most critical and limiting habitats for sagegrouse in the region are meadows adjacent to springs and seeps, and riparian areas that are used for brood rearing. The pipeline rights-of-way were selected to avoid these areas; about 1.4 acres of riparian meadow habitat would be disturbed by pipeline construction.

The water pipeline would be less than one quarter of a mile from an historic sagegrouse lek in the Bedell Flat area (Figure 3.7-2). Monitoring of this lek in recent years indicates that it may no longer be used (BLM, 1988). However, the area surrounding the lek has remained closed by the BLM to construction from March 1 to May 1 in order to avoid potential disturbance to strutting grouse. No active leks have been identified in the vicinity of the pipeline routes.

- *Raptors*

Several active raptor nesting territories were identified along the route of the water pipeline, including red-tailed hawk, Swainson's hawk, American kestrel, and great horned owl. Along the gas pipeline route, appropriate raptor nesting sites were identified in juniper trees, but no species were confirmed to be nesting. Construction activities near the nesting areas could cause raptors to abandon their nests. This is particularly true early in the nesting season, prior to or just after egg laying, and while young birds are still in the nest.

According to the proposed action, the pipeline routes would be re-surveyed for active raptor nests during the nesting season prior to the commencement of construction. Where nesting raptors are identified near the routes, construction would be delayed until the end of the critical active nesting period. Although some individual raptors could be disturbed during construction, the number that would be affected is very small relative to local populations in the area. Also, the effects would only occur during one nesting season. For these reasons, it is concluded that impacts to raptors from pipeline construction would be minor.

4.7.1.2 Indirect Impacts

- *Water Source Area*

Alteration of Shrub Communities

The potential reduction of shrub cover over 13,000 acres of the black greasewood community in eastern Honey Lake Valley could permanently alter the habitat for several species of small mammals, reptiles, and birds that occur in this area. This would probably reduce the number and diversity of small mammal and songbird species.

Densities of breeding birds are lower in open shadscale habitats than in greasewood habitats (Fautin, 1946; Smith et al., 1984; Medin, 1986). Fautin (1946) reported that total numbers of mice and jackrabbits were lower in open shadscale communities than in tall greasewood communities. However, Larrison and Johnson (1973) found that although "depleted" shadscale habitats with a high percentage of annual grasses supported fewer kinds of rodent species, these habitats supported higher rodent populations, primarily deermice. Any reduction in numbers of rodents and birds would reduce the prey base for several predator species in the area.

Planned groundwater withdrawals from Fish Springs Ranch could impact two mixed greasewood-shrub communities from reductions of black greasewood populations. The affected areas include about 18,250 acres of the black greasewood-shadscale community and 4,200 acres of the black greasewood-basin big sagebrush-basin wildrye habitats. Because other shrub cover would be retained and could reasonably be expected to replace black greasewood, productivity and wildlife carrying capacity of the affected habitats would not be expected to be significantly reduced. However, biodiversity would be altered.

The majority of the insect, small mammal, and songbird species that would be affected by alteration of the black-greasewood-dominated shrub habitats are relatively common and abundant in the region. The loss of shrub cover over 13,000 acres would likely result in reduced numbers of individuals of several of these common animal species, but it would not be expected to eliminate any of the species from Honey Lake Valley because abundant, unaffected shrub habitat would remain elsewhere in the valley. The 13,000 acres that would experience a significant reduction in shrub cover represents about six percent of the existing shrub-dominated habitat in Honey Lake Valley.

Effects on Riparian, Wet Meadow, and Wetland Habitats

Honey Lake and its associated wetlands constitute the most valuable wildlife habitats in the water source area. Groundwater pumping in Honey Lake Valley would have a negligible impact on the lake or its adjacent wetlands (Section 4.3). The lake and its wetlands are supported primarily by surface runoff, which would be unaffected by groundwater withdrawals at Fish Springs Ranch. Honey Lake Wildlife Area and Waterfowl Management are outside of the projected drawdown area. Groundwater discharge to Honey Lake from eastern Honey Lake Valley would be reduced by about 103 acre-ft/yr, which would have a negligible impact on water levels in the lake (Section 4.4).

Projected groundwater drawdown would not affect the availability of groundwater at the several ranches and home sites in eastern Honey Lake Valley. Therefore, the stands of trees and riparian-type habitat associated with these areas would not be affected by planned pumping. Small stands of trees and isolated riparian-type habitat are associated with four flowing wells in the area of Herlong Siding. Drawdown in this area from pumping at Fish Springs Ranch would not impact the yield from these wells and thus should not adversely affect these trees.

The wetlands at Bonham Ranch in the Smoke Creek Desert are extensive and represent valuable habitat for several species of wildlife, waterfowl and shorebirds (Section 3.7.2). These wetlands are supported by several flowing wells and springs. Smaller areas of wetlands also occur at Buckbrush Springs, Laird Springs, Rotten Egg Spring, and Soda Springs. Groundwater pumping in Honey Lake Valley is projected to reduce the flow of these springs and artesian wells which could reduce wetlands habitat in these areas. It is not possible to quantify the acreage of wetlands that could be affected (Section 4.5). Any loss of wetlands habitat would adversely impact a variety of shorebird and waterfowl species that are known to use this area (Appendix E). No listed or candidate species or otherwise rare or unique animal species are known to use the wetlands in the Smoke Creek Desert, although suitable nesting habitat for black terns could occur in the wetlands at Bonham Ranch.

Pronghorn Antelope

A small population of pronghorn antelope occurs in Honey Lake Valley. The primary habitat for the pronghorn are the sagebrush communities, which would not be affected by groundwater withdrawals (Section 4.6). Pronghorn rely primarily on big sagebrush for fall and winter forage, but pronghorn also use salt desert shrub habitats on the valley floor. The preferred forage in these habitats is annual forbs available during spring and early summer. Groundwater withdrawals would not affect these plant species. In several studies of pronghorn diets, black greasewood occurred only in trace amounts (Sundstrom et al., 1973; Tsukamoto, 1983). The potential loss of black greasewood from the three vegetation communities on the valley floor (Section 4.6.1.2) would therefore be expected to have little impact on pronghorn populations and use patterns in Honey Lake Valley.

Mule Deer

The Doyle deer herd uses parts of the water source area as winter range (Section 3.7.2). The bitterbrush-sagebrush vegetation community in the south part of Honey Lake Valley and on the alluvial slopes and foothills of the Fort Sage Mountains are critical mule deer winter range (Section 3.7.2). Parts of the valley that support black greasewood-dominated communities are not within the identified winter range of the Doyle deer herd and no significant use of black greasewood habitat is recorded for the deer (Fowler et al., 1982; Leach, 1956).

The primary mule deer winter browse species are antelope bitterbrush and big sagebrush (Section 3.7.2), which would not be affected by drawdown of the groundwater table (Section 4.6). Black greasewood is not recorded as occurring in the diet of the Doyle deer herd.

Therefore, groundwater withdrawals would have no significant impact on mule deer populations or on the quality of mule deer winter habitat in Honey Lake Valley.

Upland Game Birds

The areas affected by groundwater withdrawals would primarily be the lowlands of eastern Honey Lake Valley. These areas do not represent habitat for upland game birds, with the exception of small populations of California quail and mourning doves in the vicinity of ranches where trees and shrubs provide cover and where water is available. Therefore, groundwater withdrawals should not affect regional populations of sagegrouse, quail, or chukar.

Raptors

Several species of raptors winter and nest in Honey Lake Valley. They depend upon the prey base of small mammals and birds that occur throughout the shrub habitats in the valley and in the surrounding foothills. The irrigated pastures and fields, with their relatively large concentration of rodents and rabbits are also favored hunting habitat for several species of raptors. Irrigation of 1,400 acres of pasture and alfalfa would cease at Fish Springs Ranch. This would reduce the rodent and rabbit prey base for several species of hawks and for the golden eagle.

Lowering the groundwater table from pumping could cause a significant reduction in shrub cover over 13,000 acres of black greasewood community. The vegetation could change gradually from a community dominated by greasewood to one of widely scattered shadscale with an understory of annual grasses and forbs. Some studies have found that diversity of rodent species decreased, but rodent numbers increased in "depleted" shadscale with a high percentage of annuals in the community. The 13,000 acres of affected greasewood community represents about six percent of the available shrub habitat in Honey Lake Valley. Therefore, any reduction in prey base on the affected area would represent a small fraction of the potential prey base in Honey Lake Valley.

Drawdown of the groundwater table would not be expected to affect the wells near Herlong Siding, which supports 10 to 15 trees that are likely nest sites for raptors. These trees, like the majority of the isolated trees in eastern Honey Lake Valley, are associated with ranches and homesites. Planned pumping at Fish Springs Ranch would not impact the yield from these wells and thus should not impact these trees.

Shorebirds and Waterfowl

The wetland habitats used by shorebirds and waterfowl at Honey Lake would not be affected by pumping at Fish Springs Ranch. Likewise, the seasonally-flooded wetlands at Duck Lake and the open water habitats at Calneva Lake would not be affected by groundwater withdrawals. The natural flow of wells and springs at Bonham Ranch, Buckbrush Springs, Laird Springs, Rotten Egg Spring, Soda Springs, and other wetlands in the Smoke Creek Desert could be reduced by planned pumping at Fish Springs Ranch, but

quantification of the reduction and associated loss of habitat for waterfowl and shorebirds is not possible (see Section 4.5).

Fish Habitat

Within the water source area, fish habitat occurs at High Rock Spring and Bonham Ranch, but the pools and creeks in these areas support only exotic fish species (Section 3.7.2). Groundwater pumping is not projected to reduce the flow at High Rock Spring, but the groundwater table is projected to be lowered in this area by several feet. While the natural flow from existing wells at Bonham Ranch could be reduced, groundwater modelling predicts that the flow would not be eliminated. Therefore, open water at Bonham Ranch should not be eliminated and fish habitat would remain. It is unlikely that any other fish habitat exists in the water source area that would be adversely affected by groundwater pumping.

Groundwater pumping at Fish Springs Ranch is projected to reduce groundwater underflow to Pyramid Lake. The groundwater that now flows to the lake is of relatively poor quality. A major concern for all fish species in Pyramid Lake is increasing TDS concentrations (Sigler et al., 1983). Reduction in the underflow of groundwater from Honey Lake Valley via Astor Pass is projected to reduce TDS loading to the lake from this source by about 1,300 tons per years. This would be a minor benefit to the Pyramid Lake fishery. The projected reduction of inflow to Pyramid Lake of 547 acre-ft/yr from Astor Pass would be replaced with equal amounts of acquired Truckee River water rights which would then be dedicated to Pyramid Lake (see Section 2.1.5).

• *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

Growth in Lemmon Valley by the year 2015 would require about 200 acres for residential and commercial purposes (Table 4.14-1). If development occurs in areas that now support native vegetation, it would permanently remove habitat for a variety of small mammals and birds. Development in Lemmon Valley would not affect identified critical winter range or important yearlong ranges for mule deer. However, the foothills surrounding the valley provide some habitat for mule deer. As development encroaches onto these areas, available habitat for mule deer in the area would be reduced. Suburban development in the foothills would also reduce habitat for mourning dove and possibly chukar.

Growth in Spanish Springs Valley by the year 2015 would require about 8,700 acres for residential and commercial purposes (Table 4.14-1). Based on the Spanish Springs Area Plan (Washoe County, 1991a), 2,000 acres of agricultural land and 3,500 acres of salt desert shrub and big sagebrush communities would be disturbed through the year 2007 for growth. If this same land-disturbance ratio held true for growth from 1995 through 2015, then

approximately 3,170 acres of agricultural land and 5,500 acres of salt desert shrub and big sagebrush communities would be disturbed through 2015. Development would not affect identified critical winter range or important yearlong range for mule deer or pronghorn. However, the foothills at the north end of Spanish Springs Valley support small populations of mule deer. This area could also be used by the pronghorn that use the western slope of the Pah Rah Range. Increased human populations and development in Spanish Springs Valley would encroach onto this habitat. Suburban development in the foothills would also reduce habitat for mourning dove and possibly chukar.

About 1,300 acres of riparian and wet meadow/wetland vegetation now occurs in Spanish Springs Valley. The Area Plan for Spanish Springs Valley states that a system of open space, in the form of greenbelts, would be developed along the floodplain and wetland areas to preserve the natural setting (Washoe County, 1991a). However, the nearby presence of residential development and humans would likely reduce the value of these wetlands as habitat for several sensitive species of shorebirds and waterfowl.

In addition to the impact to wildlife habitat removal, population growth of 46,500 people in Lemmon and Spanish Springs Valleys would increase recreational and hunting use of the undeveloped lands surrounding these valleys. This would increase hunting pressure on local game populations and increase harassment and disturbance to wildlife from other recreational uses such as off-road vehicles.

4.7.1.3 Impacts to Endangered, Threatened, and Candidate Species

Of the listed and candidate species that potentially occur in the affected area, the following species and their habitats *do not* occur in the area that would be affected by pipeline construction, groundwater withdrawals, or growth in the delivery area: western least bittern, white-faced ibis, Pacific fisher, and the spotted bat. The following pages discuss the potential impacts to other species identified in the affected area.

- *Bald Eagle*

Proposed groundwater pumping at Fish Springs Ranch would have a negligible impact on Honey Lake and no impact to the major wetlands associated with Honey Lake, which is the prime habitat in the area for wintering bald eagles. No roost sites for bald eagle are confirmed in eastern Honey Lake Valley that would be affected by drawdown of the groundwater table.

Projected drawdown of the water table in eastern Honey Lake Valley could reduce shrub cover (black greasewood) over 13,000 acres. This could reduce the number of black-tailed jackrabbits, which may be a portion of the prey base for wintering bald eagles. The area affected represents six percent of the existing shrub habitat in Honey Lake Valley. Considering that bald eagles hunt over a large territory, it is not expected that this would cause a significant reduction in prey base for wintering eagles.

- *Peregrine Falcon*

Peregrine falcons occasionally winter at the wetlands north of Honey Lake, attracted by the large concentrations of waterfowl which are their primary prey. Groundwater pumping at Fish Springs Ranch would have a negligible impact on Honey Lake and its associated wetlands; thus, no impact would be expected to wintering peregrines. The pipeline routes and delivery area do not contain habitat for wintering peregrines.

- *Ferruginous Hawk*

Ferruginous hawks winter in the region of the pipeline routes. Pipeline construction would affect a negligible portion of the available habitat for small mammals in this region and thus should have negligible effects on the prey base for wintering ferruginous hawks.

Ferruginous hawks winter in eastern Honey Lake Valley. Pumping could modify about 13,000 of black greasewood shrub habitat to scattered shrubs and annual grasses and forbs (Section 4.6.1.2), affecting about six percent of the total shrub habitat in Honey Lake Valley. This could reduce populations of black-tailed jackrabbits and possibly rodents. However, there is evidence that rodent numbers are higher in habitats with a substantial portion of annual grasses and forbs. The reduction of prey species on six percent of the available shrub habitat in the valley should not adversely impact regional populations of wintering ferruginous hawks.

- *Northern Goshawk*

Goshawk nesting habitat could occur in the Pah Rah Range near the proposed gas pipeline (Section 3.7.4). Construction would remove a small amount of the available hunting habitat for any goshawks that could occur in the region. No nesting goshawks have been identified near the gas pipeline route. As proposed by Washoe County, a raptor nesting survey would be conducted in the year of planned project construction. Construction would be delayed until completion of the nesting period in any areas where nesting raptors are identified. Therefore, there should be no affects on nesting goshawks from pipeline construction. No known habitat for goshawks occurs in the water source area or in the delivery areas.

- *Swainson's Hawk*

Swainson's hawks could nest in isolated trees in Honey Lake Valley. Most of the trees on the floor of eastern Honey Lake Valley are associated with groundwater pumping at ranches and home sites. Groundwater pumping at Fish Springs Ranch would not affect the groundwater supply of these areas. Drawdown and alteration of shrub habitats in the valley should not significantly impact the prey base for Swainson's hawks, which consists primarily of insects.

- *Western Snowy Plover*

The western snowy plover is confirmed to nest at Honey Lake. Groundwater pumping at Fish Springs Ranch would have negligible impacts on the lake and its nearby wetlands. The

plover is also suspected of nesting in some years at seasonally flooded playas such as Duck and Calneva Lakes. These areas are primarily supported by surface runoff and would not be affected by groundwater pumping. Therefore, it would not be expected to impact habitat for, or populations of, snowy plovers in Honey Lake Valley. No habitat for plovers has been identified along the pipeline routes or within the delivery areas.

- *Greater Sandhill Crane*

Greater sandhill cranes are known to use Honey Lake and its associated wetlands, as well as seasonally-flooded areas including Duck and Calneva Lakes. As discussed above, these habitats would not be affected by groundwater pumping at Fish Springs Ranch. No habitat for sandhill cranes has been identified along the pipeline routes or within the delivery areas.

- *Black Tern*

Within the affected area, nesting habitat for black terns could occur in the wetlands at Bonham Ranch; however, no nesting terns have been confirmed there. Groundwater pumping at Fish Springs Ranch could reduce wetlands habitat in this area and thus could impact potential habitat for the terns.

Habitat for black terns could also exist at the wetlands in Spanish Springs Valley. Any reductions in wetlands due to residential and commercial development in Spanish Springs Valley could reduce potential habitat for black terns. However, current plans for this area include policies for wetland preservation.

- *Bank Swallow*

Projected drawdown of the groundwater table would not affect nesting habitat for bank swallows, which consists of sand and gravel streambanks. Groundwater pumping would also not affect the insect prey base for the swallows. Construction of the pipelines would also not affect streambank habitat in the pipeline region. It would not affect the nesting habitat or the insect prey base of the bank swallow.

- *Loggerhead Shrike*

Construction of the pipelines would disturb about 900 acres of shrub hunting habitat for shrikes and potentially some nesting habitat. The disturbance corridor would be narrow and would thus be expected to impact only a small portion of any individual shrike's territory. The rights-of-way do not offer any unique habitat requirements for the shrike that are not also present in surrounding shrub habitat. Therefore, pipeline construction should have minor effects on shrikes in the region.

Loggerhead shrikes occur in the greasewood shrub communities in eastern Honey Lake Valley. They are likely to use tall black greasewood shrubs for nesting. Groundwater pumping at Fish Springs Ranch could reduce greasewood density and shrub cover on about 13,000 acres over 100 years. This would represent a gradual reduction of habitat for the shrike over about six percent of Honey Lake Valley. Shrike habitat in the other shrub

communities on the valley floor would not be affected by loss of greasewood because other non-phreatophytic shrubs in these areas would not be affected. Considering that abundant, unaffected habitat for the shrike would remain in Honey Lake Valley, the loss of approximately six percent of the shrike's habitat in this area should not significantly affect regional populations of this species.

Residential and commercial construction in the undeveloped shrub habitats in Lemmon and Spanish Springs Valleys could also impact suitable habitat for the loggerhead shrike. As much as 6,700 acres of sagebrush and salt desert shrub communities could potentially be affected by future development in the delivery area indirectly associated with the proposed rights-of-way. Some portion of the affected shrub habitats would likely constitute shrike habitat.

- *Mountain Quail*

The route of the gas pipeline crosses identified mountain quail habitat in the Pah Rah Range. Pipeline construction would disturb 10 acres of mountain quail habitat, which represents about one percent of the identified habitat there. Twenty-five acres of mountain quail habitat within the Cottonwood Creek drainage in Warm Springs Valley would be removed, which represents less than one percent of the 3,000 acres of habitat in this area (Figure 3.7-2). Removal of vegetation from the right-of-way would affect only a small portion of the habitat utilized by quail.

Construction of the gas pipeline within the area of mountain quail habitat would create new access to this area which could increase hunting pressure on the mountain quail, a legal game species. Mountain quail populations and existing hunting pressure in this area are not known. Therefore, it is difficult to quantify any potential increased mountain quail mortality from this source.

Mountain quail habitat is not known to exist in the water source area or in the delivery area.

- *Pygmy Rabbit*

The pygmy rabbit lives in areas of dense and tall sagebrush. The proposed pipeline routes have not been surveyed for pygmy rabbits, and it is possible that they occur along the rights-of-way. Construction of the proposed pipelines would disturb about 477 acres of big sagebrush habitat, an undetermined portion of which may constitute suitable habitat for the pygmy rabbit. Removal of this vegetation along the narrow pipeline corridor is likely to impact only a portion of an individual rabbit's home range; abundant similar undisturbed habitat would remain on either side of the right-of-way. Therefore, loss of habitat from pipeline construction should have minor effects on local populations of the pygmy rabbit.

Groundwater pumping at Fish Springs Ranch would not impact sagebrush communities in the water source area and would therefore not impact habitat for the pygmy rabbit.

Future residential and commercial construction in both Lemmon and Spanish Springs Valleys could reduce pygmy rabbit habitat in these areas. This impact cannot be quantified with available data.

- *Cui-ui and Lahontan Cutthroat Trout*

Both of these listed fish species are discussed together because they both depend upon the Pyramid Lake-Truckee River system. The critical factor for re-establishing naturally reproducing populations of both species is the maintenance of sufficient flow in the lower Truckee River to allow successful spawning and ensure survival of eggs and larvae (Section 3.7.4). Maintenance of sufficiently high water levels in Pyramid Lake is also critical to allow access to the river by cui-ui.

Groundwater pumping at Fish Springs Ranch is projected to reduce the underflow of groundwater from Honey Lake Valley directly to Pyramid Lake by 547 acre-feet/yr and reduce the underflow of groundwater from the Smoke Creek Desert to Pyramid Lake by 847 acre-feet/yr. The projected reduction of groundwater flow to the Pyramid Lake Basin of approximately 1,400 acre-ft/yr would be replaced by Washoe County with equal amounts of acquired Truckee River water rights which would then be dedicated to Pyramid Lake. Therefore, the project would not affect the water level of Pyramid Lake. Moreover, the project could have slight beneficial impacts to the cui-ui if the acquired water rights that would be dedicated to the lake are released during the cui-ui spawning season.

Increasing concentrations of TDS and alkalinity in Pyramid Lake are also of concern to the continued well-being of both the cui-ui and the Lahontan cutthroat trout. Because the groundwater that flows to Pyramid Lake from Honey Lake Valley and the Smoke Creek Desert is of poorer quality than the acquired Truckee River water that would replace it (Section 4.3), the project could slightly improve the quality of Pyramid Lake, benefitting both species.

Consultation with the U.S. Fish and Wildlife Service under Section 7 of the Endangered Species Act concluded that the proposed action is not likely to adversely affect the Lahontan cutthroat trout or the cui-ui.

4.7.1.4 Conclusions

Construction of the proposed pipelines would impact wildlife populations by loss or displacement of individuals during construction, increased human activity at construction sites, and by loss or alteration of habitat from the removal of about 940 acres of vegetation. The loss and displacement of individuals would be temporary, lasting for the nine-month duration of construction. Habitat loss would continue until restoration of vegetation cover is accomplished. Perhaps two to three years would be required for re-establishment of vegetative cover, and as long as 10 to 15 years for establishment of mature shrub growth.

Drawdown of the groundwater table in eastern Honey Lake Valley could reduce shrub cover over 13,000 acres of black greasewood community. This could reduce species diversity for

some small mammals and birds, but it could increase the carrying capacity for some rodent populations. It could reduce the availability of prey species for several mammalian predators and raptors. These 13,000 acres represent about six percent of the available shrub habitat in Honey Lake Valley. Impacts to Honey Lake and the wetlands around the lake would be negligible.

Pumping at Fish Springs Ranch could reduce the flow of springs and artesian wells in the Smoke Creek Desert. This could reduce wetlands habitat at Bonham Ranch, Buckbrush Springs, Laird Springs, Rotten Egg Spring, Soda Spring, and at several other isolated springs and seeps along the southwestern edge of the Smoke Creek Desert. If this occurred, it would impact several species of waterfowl and shorebirds that utilize the wetlands at the ranch.

The projected reduction of groundwater flow to the Pyramid Lake Basin of approximately 1,400 acre-ft/yr would be replaced by Washoe County with equal amounts of acquired Truckee River water rights which would then be dedicated to Pyramid Lake. This could result in some beneficial impacts to threatened and endangered species in the lake.

Population growth in Lemmon and Spanish Springs Valleys would have some adverse impacts on wildlife in surrounding areas due to increased hunting pressure, habitat disturbance associated with commercial and residential development, and harassment.

4.7.2 *Alternative Routes*

The indirect impacts that would occur to wildlife in the water source area and in Lemmon Valley and Spanish Springs Valley from selection of any of the alternative pipeline routes would be similar to those described under the proposed Bedell Flat route. Projected drawdown of the groundwater table in eastern Honey Lake Valley would reduce species diversity for some small mammals and birds, and reduce the availability of prey species for several mammalian predators and raptors. Flow in springs and artesian wells that support wetlands in the Smoke Creek Desert could be reduced, thereby reducing wetlands habitat. This would affect several species of waterfowl and shorebirds that utilize these wetlands. The flow of poor-quality groundwater to Pyramid Lake from Honey Lake Valley and the Smoke Creek Desert would be replaced with better quality water from the Truckee River, possibly benefitting the cui-ui and Lahontan cutthroat trout. Population growth in Lemmon and Spanish Springs Valleys would have some adverse impacts on wildlife in surrounding areas due to habitat removal, increased hunting pressure, and harassment.

Table 4.7-1 compares the potential acreage impacts to selected wildlife habitats among the proposed or alternative pipeline routes.

4.7.2.1 *Winnemucca Valley Route*

Construction of the pipelines along the Winnemucca Valley route would disturb 740 acres of sagebrush and 155 acres of salt desert shrub habitats. The Winnemucca Valley route would disturb 4.6 acres of riparian and wet meadow habitat.

TABLE 4.7-1 COMPARISON OF IMPACTS TO GAME SPECIES FROM PROPOSED AND ALTERNATIVE ROUTES (in acres)				
Nature of Impact	Bedell Flat Route	Red Rock Valley Alt.	Antelope Valley Alt.	Winnemucca Valley Alt.
Disturbance to riparian-wet meadow habitat	1.4	13.6	1.4	4.6
Disturbance to critical/crucial mule deer range	0	40	0	0
Disturbance to mule deer summer/winter range	100	100	100	135
Disturbance to pronghorn use area	340	340	290	240
Disturbance to sagegrouse use area	90	120	90	60
Disturbance to mountain quail habitat (candidate species)	35	35	35	35

The route would cross mule deer summer/winter range in the Pah Rah Range and the edge of identified winter range in the western foothills of the Virginia Mountains, resulting in a total disturbance to about 135 acres of mule deer winter/summer range (Figure 3.7-1). None of the mule deer range crossed by the Winnemucca Valley route is considered critical or crucial winter range by the BLM or NDOW. Sagebrush-antelope bitterbrush vegetation communities are important to wintering mule deer in the region. The Winnemucca Valley route would disturb about 195 acres of this vegetation type (Table 4.6-3).

The Winnemucca Valley route crosses the western edge of the Dry Valley-Bedell Flat-Hungry Valley pronghorn use area and also crosses the pronghorn use area on the western side of the Pah Rah Range; pipeline construction would disturb 240 acres of pronghorn habitat.

The Winnemucca Valley route avoids the historic sagegrouse use area in Bedell Flat and would not cross the identified sagegrouse use area in the Sand Hills-Bedell Flat area. It would, however, cross the sagegrouse use area in the Pah Rah Range, affecting about 60 acres of this habitat (Figure 3.7-2). The Winnemucca Valley route would not be near any known sagegrouse leks.

The gas pipeline route between Wadsworth and Warm Springs Valley would cross identified habitat for the mountain quail, a candidate species, and would disturb about 35 acres of mountain quail habitat in the Pah Rah Range (Figure 3.7-2). The Winnemucca Valley route would also disturb big sagebrush communities that could be habitat for the pygmy rabbit and loggerhead shrike, both candidate species (Section 3.7.1.4).

4.7.2.2 *Antelope Valley Route*

Construction of the pipelines along the Antelope Valley route would disturb 145 acres of salt desert shrub and 785 acres of sagebrush habitats. The Antelope Valley route would disturb 1.4 acres of riparian/wet meadow habitat.

The Antelope Valley route would cross mule deer summer/winter range in the Pah Rah Range, resulting in a total disturbance to about 100 acres of mule deer winter/summer range (Figure 3.7-1). The Pah Rah Range is not critical or crucial winter range. Pipeline construction along the Antelope Valley route would remove about 245 acres of sagebrush/antelope bitterbrush habitat, which constitutes valuable mule deer browse (Table 4.6-3).

The Antelope Valley route crosses a pronghorn antelope use area on the western side of the Pah Rah Range. It also crosses the Dry Valley-Bedell Flat-Hungry Valley pronghorn use area, which would disturb 290 acres of identified pronghorn use areas (Figure 3.7-2).

The Antelope Valley route crosses a sagegrouse use area in Bedell Flat and passes close to an historic lek that is currently unused. The route also crosses the sagegrouse use area in the Pah Rah Range (Figure 3.7-2). Construction of the water and gas pipelines along this route would disturb 90 acres of sagegrouse habitat.

The Antelope Valley route would cross identified habitat for the mountain quail, a candidate species, and would disturb about 35 acres of mountain quail habitat in the Pah Rah Range (Figure 3.7-2). It would also disturb big sagebrush communities that could be habitat for the pygmy rabbit and loggerhead shrike, both candidate species (Section 3.7.1.4).

4.7.2.3 *Red Rock Valley Route*

Construction of the pipelines along the Red Rock Valley route would disturb 955 acres of sagebrush and 165 acres of salt desert shrub habitat. It would disturb 13.6 acres of riparian/wet meadows habitat.

The Red Rock Valley route would cross mule deer summer/winter range in the Pah Rah Range, which would disturb about 100 acres of mule deer habitat. It would also cross 40 acres of identified winter range in the Sand Hills that is considered by NDOW as critical to wintering deer from the Lassen-Washoe Interstate deer herd (Figure 3.7-1). The route would require the removal of about 380 acres of valuable deer browse in sagebrush-antelope bitterbrush vegetation communities (Table 4.6-3).

The Red Rock Valley route crosses the pronghorn use area on the western side of the Pah Rah Range. It also crosses the Dry Valley-Bedell Flat-Hungry Valley pronghorn use area in two places along both the water and gas pipeline routes. Total disturbance of identified pronghorn use areas along this route would be 340 acres.

The route crosses both the Sand Hills-Bedell Flat sagegrouse use area and the Pah Rah Range use area; total disturbance in these areas would amount to 120 acres (Figure 3.7-2). The route would pass within about 1.5 miles of an active lek in the Sand Hills.

The Red Rock Valley route would cross mountain quail habitat in the Pah Rah Range, disturbing about 35 acres (Figure 3.7-2). Disturbances within some segments of the route that cross stands of big sagebrush could disturb habitat for the pygmy rabbit and loggerhead shrike, both candidate species (Section 3.7.1.4).

4.7.3 *No Action Alternative*

Under the no action alternative, the rights-of-way would be denied. Removal of wildlife habitat for construction of the pipelines and the ancillary facilities in Honey Lake Valley would not occur. The owners of Fish Springs Ranch would retain the rights to approximately 14,000 acre-ft of water, some portion of which would presumably be put to beneficial use. Impacts to wildlife from use of this water are unknown.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.7.3.1 *Supply Side Sub-Alternative*

Groundwater pumping associated with this sub-alternative could lower the groundwater table in localized areas in the Truckee Meadows, thereby affecting wildlife habitat that is maintained by near-surface groundwater. Impacts to this habitat, especially wetlands vegetation, can not be assessed because the locations of the four new wells associated with this sub-alternative are not known.

The supply side sub-alternative also includes the conversion of Truckee River irrigation rights to municipal and industrial uses. This would reduce the acreage of irrigated pasture and alfalfa lands, thereby reducing habitat for the several species of small mammals and birds that use these habitats. Reductions in irrigation could also result in the loss of wet meadow/wetland habitat, particularly in the southwest Truckee Meadows and in Spanish Springs Valley, where this habitat is maintained by seepage from irrigation ditches. These land conversions, however, must comply with federal wetland regulations, as well as regional and local wetlands policies.

Under the supply side sub-alternative, growth in Lemmon Valley by the year 2015 would require about 100 acres for residential and commercial purposes; a very small amount of land over a 20-year period. If development occurs in areas that presently support native vegetation, permanent removal of habitat for a variety of small mammals and birds that now use these shrub habitats would occur. This development would not affect identified critical winter range or important yearlong ranges for mule deer. However, the foothills surrounding the valley provide some habitat for mule deer. As development encroaches onto these areas, available habitat for mule deer in the area would be reduced. Suburban development into the foothills would also reduce habitat for the mourning dove and possibly chukar.

Growth in Spanish Springs Valley by the year 2015 would require 2,400 acres for residential and commercial purposes. Some of this development would affect agricultural lands. The balance of the projected development would affect native shrub vegetation communities. Development would not affect identified critical winter range or important yearlong range for mule deer or pronghorn. However, the foothills at the north end of Spanish Springs Valley support small populations of mule deer and could also be used by the group of pronghorn that uses the western slopes of the Pah Rah Range. Increased human populations and development in Spanish Springs would encroach onto this habitat. Suburban development in the foothills would also reduce habitat for the mourning dove and possibly chukar.

About 1,300 acres of riparian and wet meadow/wetland vegetation now exist in Spanish Springs Valley. Conversion of agricultural land to urban land and the resulting change in irrigation practices could reduce some of the existing wetlands in the area. This is expected to be minimal because plans for the area include policies for protection of wetlands in open space and greenbelts. Also, these land conversions must comply with federal wetland regulations, as well as regional and local wetlands policies. Nevertheless, the nearby presence of residential development and humans could reduce the value of these wetlands as habitat for several sensitive species of shorebirds and waterfowl.

Between 1995 and 2015, population growth in the Truckee Meadows under the supply side sub-alternative would require 1,800 acres for residential and commercial development. An undetermined percentage of this development would likely impact vacant land within the populated parts of the Truckee Meadows. The balance would require the removal of native habitat for the several wildlife species characteristic of the shrub habitats that would be affected. Peavine Mountain, the foothills of the Carson Range, and the Mount Rose fan are key winter habitat for the Loyalton-Truckee interstate mule deer herd. Residential development in the western and southwestern Truckee Meadows suburban areas has already resulted in substantial loss of important winter habitat for this deer herd.

In addition to the impact from removal of wildlife habitat, the additional 35,400 people in the metropolitan area under this sub-alternative would increase recreational and hunting use of the undeveloped lands surrounding the metropolitan area. This would increase hunting pressure on local game populations and increase harassment and disturbance to wildlife from other recreational uses such as off-road vehicles.

As the Reno-Sparks metropolitan area grows under this sub-alternative, the volume of treated wastewater would also increase. An unknown proportion of this effluent could pass through the Truckee Meadows Water Reclamation Facility for disposal in the Truckee River. This effluent would have both positive and negative effects on the Truckee River and the cui-ui and Lahontan cutthroat trout (EPA, 1984). Other wastewater disposal options would also be available.

4.7.3.2 Demand Side Sub-Alternative

Water conservation would have some benefits for wildlife habitat. Xeriscaping would promote native plants which require not only less water, but fewer fertilizers and pesticides.

Reducing the rate of increase of water use in the metropolitan area would benefit riparian areas, wetlands, and the Truckee River, which are all important wildlife habitats.

4.7.3.3 Negotiated Settlement Sub-Alternative

Section 206 of the Negotiated Settlement Act authorizes and directs the Secretary of the Interior to acquire water rights to sustain 25,000 acres of wetlands in Lahontan Valley east of Fallon, Nevada, and to expand the Stillwater National Wildlife Refuge. Section 207 of the Act authorizes and directs the Secretary of the Interior to acquire water rights and develop plans for the conservation and recovery of the cui-ui and Lahontan cutthroat trout. The U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation are currently preparing an EIS on the operation of Truckee River reservoirs for release in the mid-1990s.

Growth in Lemmon Valley under this sub-alternative by the year 2015 would require about 200 acres for residential and commercial purposes. If development occurs in areas that presently support native vegetation, it would permanently remove habitat for a variety of small mammals and birds. Development in Lemmon Valley would not affect identified critical winter range or important yearlong ranges for mule deer. However, the foothills surrounding the valley provide some habitat for mule deer. As development encroaches onto these areas, available habitat for mule deer in the area would be reduced. Suburban development into the foothills would also reduce habitat for the mourning dove and possibly chukar.

Growth in Spanish Springs Valley by the year 2015 would require 8,700 acres for residential and commercial purposes. Based on the Spanish Springs Area Plan (Washoe County, 1991a), 2,000 acres of agricultural land and 3,500 acres of salt desert shrub and big sagebrush communities would be disturbed through the year 2007 for growth. If this same land-disturbance ratio held true for growth from 1995 through 2015, then approximately 3,170 acres of agricultural land and 5,500 acres of salt desert shrub and big sagebrush communities would be disturbed through 2015. Development would not affect identified critical winter range or important yearlong range for mule deer or pronghorn. However, the foothills at the north end of Spanish Springs Valley support small populations of mule deer. This area could also be used by the group of pronghorn that use the western slope of the Pah Rah Range. Increased human populations and development in Spanish Springs Valley would encroach onto this habitat. Suburban development in the foothills would also reduce habitat for the mourning dove and possibly chukar.

About 1,300 acres of riparian and wet meadow/wetland vegetation now exists in Spanish Springs Valley. Conversion of agricultural land to urban land and the resulting change in irrigation practices could reduce some of the existing wetlands in the area. This is expected to be minimal because current plans for the area include policies for protection of wetlands in open space and greenbelts. Also, these land conversions must comply with federal wetland regulations, as well as regional and local wetlands policies. Nevertheless, the nearby presence of residential development and humans could reduce the value of these wetlands as habitat for several sensitive species of shorebirds and waterfowl.

Between 1995 and 2015, population growth in the Truckee Meadows under this sub-alternative could require 7,400 acres for residential and commercial development. An

undetermined percentage of this development would likely impact vacant land within the populated parts of the Truckee Meadows. The balance would require the removal of native habitat for the several wildlife species characteristic of the shrub habitats that would be affected. Peavine Mountain, the foothills of the Carson Range, and the Mount Rose fan are key winter habitat for the Loyalton-Truckee interstate mule deer herd. Residential development in the western and southwestern Truckee Meadows suburban areas has already resulted in substantial loss of important winter habitat for this deer herd.

In addition to the impact from the removal of wildlife habitat, the additional 139,300 people in the Reno-Sparks metropolitan area under this sub-alternative would increase recreational and hunting use of nearby undeveloped lands. This could increase hunting pressure on local game populations and increase harassment and disturbance of wildlife from such activities as off-road-vehicle use.

As the Reno-Sparks metropolitan area grows under this sub-alternative, the volume of treated wastewater would also increase. An unknown proportion of this effluent could pass through the Truckee Meadows Water Reclamation Facility for disposal in the Truckee River. This effluent would have both positive and negative effects on the Truckee River and the cui-ui and Lahontan cutthroat trout (EPA, 1984). Other wastewater disposal options would also be available.

4.8 WILD HORSES

4.8.1 Proposed Action

4.8.1.1 Direct Impacts

No substantial adverse impacts are expected to wild horses from construction and operation of the proposed pipelines (see Figure 3.8-1). At any one time, six widely separated areas of construction would occur along the water and gas pipelines. Horses would be disturbed somewhat by the operation of heavy equipment, but they are feral animals and are capable of adapting to human disturbance. No trenches would be left open at the end of each work day.

Wild horses regularly cover long distances to water each day. Horses could easily avoid areas of construction, and would be likely to adapt to short-term disturbances. They would either use alternative water sources, or move parallel to construction zones to cross the rights-of-way. Wild horses can be expected to adapt to this type of disturbance.

4.8.1.2 Indirect Impacts

• Water Source Area

The Twin Peaks, Flanigan, and Fort Sage Herd Management Areas (HMAs) are partly within the area where drawdown of the water table is projected. The HMAs are located in the foothills and mountains surrounding Honey Lake Valley. Surface water in these HMAs is supplied by perched aquifers and by rain and snow that percolates through the rock and

discharges at springs (meteoric water). These water sources would not be affected by projected drawdown of the water table. Similarly, the vegetation communities which provide habitat and forage for wild horses and burros in these areas are not phreatophytic and would not be impacted by drawdown. For these reasons, impacts to wild horses and burros from planned groundwater pumping at Fish Springs Ranch would be negligible.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

No HMAs are located in Lemmon and Spanish Springs Valleys. As the area continues to grow, however, conflicts are likely to increase among land owners, wild horses, and recreational users of public lands as access improves and demands for dispersed outdoor recreation increase.

4.8.2 Alternative Routes

The indirect impacts that would occur to wild horses in the water source area and in Lemmon and Spanish Springs Valley from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. The projected regional drawdown of the water table in Honey Lake Valley, and possible changes in vegetation composition, are not expected to impact any HMAs. Population growth indirectly associated with the alternative pipeline routes would increase conflicts between private landowners, wild horses, and recreational users of public lands.

4.8.2.1 Winnemucca Valley

Bedell Flat would be avoided by selection of the Winnemucca Valley alternative route (see Figure 3.8-1). No substantial impacts to wild horses would be expected, and no HMAs would be affected. Horses would be disturbed somewhat by the operation of heavy equipment, but they are feral animals and are capable of adapting to human disturbance. No trenches would be left open at the end of each work day.

Horses would easily avoid areas of construction, and would be likely to adapt to short-term disturbances. They would either use alternative water sources, or move parallel to construction zones to cross the rights-of-way. Wild horses can be expected to adapt to this type of construction.

4.8.2.2 Antelope Valley

No substantial impacts to wild horses would be expected from selection of the Antelope Valley alternative route (see Figure 3.8-1). No HMAs would be affected. Horses would be

disturbed somewhat by the operation of heavy equipment, but they are feral animals and are capable of adapting to human disturbance. No trenches would be left open at the end of each work day.

Horses would easily avoid areas of construction, and would be likely to adapt to short-term disturbances. They would either use alternative water sources, or move parallel to construction zones to cross the rights-of-way. Wild horses can be expected to adapt to this type of construction.

4.8.2.3 Red Rock Valley

Bedell Flat would be avoided by selection of the Red Rock Valley alternative route (see Figure 3.8-1). No substantial impacts to wild horses would be expected, and no HMAs would be affected. Horses would be disturbed somewhat by the operation of heavy equipment, but they are feral animals and are capable of adapting to human disturbance. No trenches would be left open at the end of a work day.

Horses would easily avoid areas of construction, and would be likely to adapt to short-term disturbances. They would either use alternative water sources, or move parallel to construction zones to cross the rights-of-way. Wild horses can be expected to adapt to this type of construction.

4.8.3 No Action Alternative

This alternative would have no impacts to wild horses or their habitat in the water source area or along the proposed pipeline routes.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.8.3.1 Supply Side Sub-Alternative

No HMAs would be directly affected by this sub-alternative. Increasing demands on public lands from population growth would cause some conflicts among land owners, wild horses, and recreational users of public lands.

4.8.3.2 Demand Side Sub-Alternative

Water conservation would have no impact on wild horse and burro herds because these animals only occur outside the Reno-Sparks metropolitan area.

4.8.3.3 Negotiated Settlement Sub-Alternative

No HMAs would be directly affected by this sub-alternative. Escalating demands on public lands from the large population supported by this sub-alternative through 2015 could cause some conflicts among land owners, wild horses, and recreational users of public lands.

4.9 VISUAL RESOURCES

4.9.1 Proposed Action

4.9.1.1 Direct Impacts

Impacts to visual resources would occur during clearing of the rights-of-way for the pipelines and at the water-storage site. These impacts would gradually diminish through the years as vegetation is re-established. A total of 940 acres of public and private would be disturbed. About 85 percent of the surface disturbances would be reclaimed. The remaining 140 acres would be devoted to a 15-foot-wide access road along the length of the pipeline route; it would be a permanent, though minor, visual intrusion in the affected area.

Field surveys of visually-sensitive areas were conducted at (1) the site of the terminal water-storage tanks in Lemmon Valley, (2) Bedell Flat, and (3) Olinghouse Canyon (Figure 3.9-1). Visual Contrast Rating worksheets were completed at each site. The visual impacts were evaluated by comparing the visual-contrast estimates for the proposed activities and resulting structures, with the management objectives of the VRM Classes in which they would be located.

Construction of the pipelines through Bedell Flat would cause a moderate degree of contrast for the elements of line, color, and texture. The Lahontan Resource Management Plan designates Bedell Flat and Dry Valley for roaded, general recreational opportunities. It allows rights-of-way in these areas providing that they do not alter the present undeveloped character of the valleys. A field evaluation at a key observation point at the southern end of Bedell Flat indicates that the rights-of-way would be visible largely within the "middle ground" for the elements of line and color. Over the lifetime of the project, color would blend in with the surrounding environment, whereas the element of line would still be visible. The rights-of-way through Bedell Flat would create a low to moderate level of change to the landscape, but they would be compatible with the area's recommended VRM Class III status.

During pipeline construction in Bedell Flat, Washoe County would bury the existing stock-watering tank at the south end of valley. This would cause minor beneficial impacts to the visual quality of Bedell Flat.

Construction of the gas pipeline through Olinghouse Canyon would have a low to moderate degree of contrast for the elements of line, color, and texture. The Olinghouse Canyon area is classified as VRM Class III which allows for a moderate level of change to the existing environment; it would not exceed acceptable levels of change for a VRM Class III area.

Even though the pipelines would be buried, the rights-of-way would nevertheless create a moderate horizontal to diagonal line-of-disturbance with a moderate degree of color contrast. The disturbed soil of the rights-of-way would generally appear lighter than the surrounding landscape, with less texture compared to adjacent areas with native vegetation. Over time, the visual contrast between the rights-of-way and the surrounding landscape would be reduced as the native vegetation invades the disturbed area.

Construction of two water tanks in Lemmon Valley would cause a moderate to strong degree of contrast for the elements of form, line, and texture (Figures 2-3 and 2-4). Although the tanks would be visible from certain vantage points, the contrast would not exceed acceptable levels for a VRM Class IV area.

4.9.1.2 Indirect Impacts

- *Water Source Area*

Minor, though long-term impacts to visual resources would occur from clearing of vegetation for the pump station, the telemetry building, and the well sites at Fish Springs Ranch.

Visual impacts in Honey Lake Valley would occur as vegetative cover over an area of 13,000 acres is reduced and altered due to groundwater pumping. This impact is expected to occur gradually over a period of 100 years. It would eventually be evident from vantage points in the surrounding mountains, including the two *wilderness study areas* north of the valley. Most of the shrub cover that would be affected is on private lands. Visually, the reduction of shrub cover could be considered a substantial impact by property owners in the area.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

The visual setting of Lemmon and Spanish Springs Valleys would be substantially altered by this growth. The current rural/agricultural setting would gradually be replaced by a suburban/urban visual atmosphere.

4.9.2 Alternative Routes

The indirect impacts that would occur to visual resources in the water source area and in Lemmon Valley and Spanish Springs Valley from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. Briefly, adverse visual impacts in Honey Lake Valley would occur as vegetative cover in the valley is reduced due to groundwater pumping. Population growth in Lemmon and Spanish

Springs Valleys would alter the visual settings of these areas, especially the current rural/agricultural settings of Lemmon and Spanish Springs Valleys.

4.9.21 *Winnemucca Valley*

Routing the water and gas pipelines through Winnemucca Valley would avoid Bedell Flat. Lands affected are all assigned to VRM Classes III and IV (Figure 3.9-1).

Impacts to visual resources would occur during clearing of the rights-of-way for the pipelines and at the water-storage site. These impacts would gradually diminish through the years as vegetation is re-established. A total of 928 acres of public and private land would be disturbed. About 85 percent of the surface disturbances would be reclaimed. The remaining 140 acres would be devoted to a 15-foot-wide access road along the length of the pipeline route; it would be a permanent, though minor, visual intrusion in the affected area. Over the lifetime of the project, color would blend in with the surrounding environment, whereas the element of line would still be visible.

Construction of the gas pipeline through Olinghouse Canyon would have a low to moderate degree of contrast for the elements of line, color, and texture. The Olinghouse Canyon area is classified as VRM Class III which allows for a moderate level of change to the existing environment; it would not exceed acceptable levels of change for a VRM Class III area.

Even though the pipelines would be buried, the rights-of-way would nevertheless create a moderate horizontal to diagonal line-of-disturbance with a moderate degree of color contrast. The disturbed soil of the rights-of-way would generally appear lighter than the surrounding landscape, with less texture compared to adjacent areas with native vegetation. Over time, the visual contrast between the rights-of-way and the surrounding landscape would be reduced as the native vegetation invades the disturbed area.

Construction of two water tanks in Lemmon Valley would cause a moderate to strong degree of contrast for the elements of form, line, and texture (Figures 2-3 and 2-4). Although the tanks would be visible from certain vantage points, the contrast would not exceed acceptable levels for a VRM Class IV area.

4.9.22 *Antelope Valley*

Impacts to visual resources would occur during clearing of the rights-of-way for the pipelines and at the water-storage site. These impacts would gradually diminish through the years as vegetation is re-established. A total of 959 acres of public and private land would be disturbed. About 85 percent of the surface disturbances would be reclaimed. The remaining 140 acres would be devoted to a 15-foot-wide access road along the length of the pipeline route; it would be a permanent, though minor, visual intrusion in the affected area.

Construction of the pipelines through Bedell Flat would cause a moderate degree of contrast for the elements of line, color, and texture. The Lahontan Resource Management Plan designates Bedell Flat and Dry Valley for roaded, general recreational opportunities. It allows rights-of-way in these areas providing that they do not alter the present undeveloped

character of the valleys. A field evaluation at a key observation point at the southern end of Bedell Flat indicates that the rights-of-way would be visible largely within the "middle ground" for the elements of line and color. Over the lifetime of the project, color would blend in with the surrounding environment, whereas the element of line would still be visible. The rights-of-way through Bedell Flat would create a low to moderate level of change to the landscape, but they would be compatible with the area's recommended VRM Class III status.

During pipeline construction in Bedell Flat, Washoe County would bury the existing stock-watering tank at the south end of valley. This would cause minor beneficial impacts to the visual quality of Bedell Flat.

Construction of the gas pipeline through Olinghouse Canyon would have a low to moderate degree of contrast for the elements of line, color, and texture. The Olinghouse Canyon area is classified as VRM Class III which allows for a moderate level of change to the existing environment; it would not exceed acceptable levels of change for a VRM Class III area.

Even though the pipelines would be buried, the rights-of-way would nevertheless create a moderate horizontal to diagonal line-of-disturbance with a moderate degree of color contrast. The disturbed soil of the rights-of-way would generally appear lighter than the surrounding landscape, with less texture compared to adjacent areas with native vegetation. Over time, the visual contrast between the rights-of-way and the surrounding landscape would be reduced as the native vegetation invades the disturbed area.

Construction of two water tanks in Lemmon Valley would cause a moderate to strong degree of contrast for the elements of form, line, and texture (Figures 2-3 and 2-4). Although the tanks would be visible from certain vantage points, the contrast would not exceed acceptable levels for a VRM Class IV area.

4.9.23 Red Rock Valley

Routing the water and gas pipelines through Red Rock Valley would avoid Bedell Flat. Lands affected are all assigned to VRM Classes III and IV. Impacts to visual resources would occur during clearing of the rights-of-way for the pipelines and at the water-storage site. These impacts would gradually diminish through the years as vegetation is re-established. A total of 1,179 acres of public and private land would be disturbed. About 85 percent of the surface disturbances would be reclaimed. The remaining 140 acres would be devoted to a 15-foot-wide access road along the length of the pipeline route; it would be a permanent, though minor, visual intrusion in the affected area. Over the lifetime of the project, color would blend in with the surrounding environment, whereas the element of line would still be visible.

Construction of the gas pipeline through Olinghouse Canyon would have a low to moderate degree of contrast for the elements of line, color, and texture. The Olinghouse Canyon area is classified as VRM Class III which allows for a moderate level of change to the existing environment; it would not exceed acceptable levels of change for a VRM Class III area.

Even though the pipelines would be buried, the rights-of-way would nevertheless create a moderate horizontal to diagonal line-of-disturbance with a moderate degree of color contrast. The disturbed soil of the rights-of-way would generally appear lighter than the surrounding landscape, with less texture compared to adjacent areas with native vegetation. Over time, the visual contrast between the rights-of-way and the surrounding landscape would be reduced as the native vegetation invades the disturbed area.

Construction of two water tanks in Lemmon Valley would cause a moderate to strong degree of contrast for the elements of form, line, and texture (Figures 2-3 and 2-4). Although the tanks would be visible from certain vantage points, the contrast would not exceed acceptable levels for a VRM Class IV area.

4.9.3 No Action Alternative

If the rights-of-way are not issued, none of the visual impacts described along the pipeline routes, in the water source area, or in the delivery/use area would occur. The existing stock-watering tank at the south end of Bedell Flat would not be buried.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.9.3.1 Supply Side Sub-Alternative

By 2015, this sub-alternative would support 12,700 people in Lemmon and Spanish Springs Valleys. As this growth occurs, the current rural/agricultural setting of these areas would gradually be replaced by a suburban/urban setting.

Visual impacts in the Truckee Meadows would continue due to urbanization from the addition of 22,700 people by 2015. This would be most evident where irrigated lands and meadows are converted to residential and commercial settings.

4.9.3.2 Demand Side Sub-Alternative

Water conservation and corresponding changes in the urban landscape, especially xeriscaping in the Reno-Sparks metropolitan area, would introduce a new visual character to growing neighborhoods. Visual contrasts would decrease between native and residential vegetation along the fringe of the growing metropolitan area.

4.9.3.3 Negotiated Settlement Sub-Alternative

By 2015, the negotiated settlement would support 46,500 people in Lemmon and Spanish Springs Valleys. As this growth occurs, the current rural/agricultural setting of these valleys would gradually be replaced by a suburban/urban setting.

From 1995 to 2015, the negotiated settlement would support an additional 92,800 people in the Truckee Meadows. This growth would continue the urbanization of the Truckee Meadows. The visual setting of the Truckee Meadows would be substantially altered as a result of this growth; it would be most evident where irrigated lands and meadows are converted to residential and commercial settings.

4.10 CULTURAL RESOURCES

4.10.1 Proposed Action

4.10.1.1 Direct Impacts

Two significant prehistoric sites occur near the proposed Bedell Flat route. Both are located near the gas pipeline route in the Pah Rah Range. The Wild Horse Spring site (CrNV-31-4261) is in a remote area, but it is adjacent to an exiting road. The gas pipeline would pass 200 feet north of this site. Nearby pipeline construction could increase access to this site and vandalism. The Cottonwood Creek site (CrNV-31-4256) is bisected by the Wilcox Ranch Road. It has been extensively looted. The gas pipeline would pass 100 feet north of this site. Pipeline construction in this area could affect the Cottonwood Creek site from increased human presence and further vandalism and looting.

Seven significant historic sites occur near the proposed Bedell Flat route. All are located in Olinghouse Canyon within several hundred feet of the proposed route of the gas pipeline. Even though the gas pipeline right-of-way would be narrower in this area, as well as maneuvered to avoid these resources, all seven sites would be temporarily affected during pipeline construction due to noise, dust, and disturbance.

An archaeologist would be retained on site during pipeline construction to assist in avoiding impacts to cultural resources. Dust would be controlled as a part of the permit for a grading plan. After pipeline construction is completed, no other impacts to significant historic cultural resources would be expected.

4.10.1.2 Indirect Impacts

• Water Source Area

No significant archaeological resources (eligible for nomination to the National Register of Historic Places) would be affected by the construction of the ancillary facilities in Honey Lake Valley such as the wells and collection system, power station, storage tanks, and the telemetry building. No other impacts to cultural resources would occur in the water source area because there would be no other surface disturbances.

• Delivery/Use Area

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water

for this growth. Water supply is one component of the infrastructure needed to support this population.

Population growth would disturb land for residential, commercial, and industrial developments. These disturbances have the potential to impact cultural resources. Surveys are required for cultural resources as a part of the conservation element of the Washoe County Comprehensive Plan. Effects from development in Lemmon and Spanish Springs Valleys would be mitigated by surveys and avoidance or professional treatment of cultural resources. Adverse effects could nevertheless occur due to increased access, vandalism, and unauthorized collection of cultural resources associated with population growth. However, analysis of these impacts is beyond the scope of this EIS.

4.10.2 Alternative Routes

4.10.2.1 Winnemucca Valley

Four significant prehistoric sites occur near the Winnemucca Valley route. Two are located near the gas pipeline route in the Pah Rah Range. The other two are in Warm Springs Valley and Winnemucca Valley, and would be traversed by both the water and gas pipelines.

The Wild Horse Spring site (CrNV-31-4261) is in a remote area, but it is adjacent to an exiting road. The gas pipeline would pass 200 feet north of this site. Nearby pipeline construction could increase access to this site and vandalism. The Cottonwood Creek site (CrNV-31-4256) is bisected by the Wilcox Ranch Road. It has been extensively looted. The gas pipeline would pass 100 feet north of this site. Pipeline construction in this area could affect the Cottonwood Creek site from increased human presence and further vandalism and looting.

Construction of the water and gas pipelines through Winnemucca Valley would directly affect both the Warm Springs Valley site (CrNV-31-3247) and the Winnemucca Valley site (CrNV-31-4364) because each is too large to avoid. Both sites would require testing to (1) evaluate subsurface content, (2) increase the amount of site data, and (3) develop a data-retrieval plan. Other effects to both sites include increased visits to the area and potential looting and vandalism.

Seven significant historic sites occur near the Winnemucca Valley route. All are located in Olinghouse Canyon within several hundred feet of the proposed route of the gas pipeline. Even though the gas pipeline right-of-way would be narrower in this area, as well as maneuvered to avoid these resources, all seven sites would be temporarily affected during pipeline construction due to noise, dust, and disturbance.

An archaeologist would be retained on site during pipeline construction to assist in avoiding impacts to cultural resources. Dust would be controlled as a part of the permit for a grading plan. After pipeline construction is completed, no other impacts to significant historic cultural resources would be expected.

4.10.2.2 Antelope Valley

Two significant prehistoric sites occur near the Antelope Valley route. Both are located near the gas pipeline route in the Pah Rah Range. The Wild Horse Spring site (CrNV-31-4261) is in a remote area, but it is adjacent to an exiting road. The gas pipeline would pass 200 feet north of this site. Nearby pipeline construction could increase access to this site and vandalism. The Cottonwood Creek site (CrNV-31-4256) is bisected by the Wilcox Ranch Road. It has been extensively looted. The gas pipeline would pass 100 feet north of this site. Pipeline construction in this area could affect the Cottonwood Creek site from increased human presence and further vandalism and looting.

Seven significant historic sites occur near the proposed Bedell Flat route. All are located in Olinghouse Canyon within several hundred feet of the proposed route of the gas pipeline. Even though the gas pipeline right-of-way would be narrower in this area, as well as maneuvered to avoid these resources, all seven sites would be temporarily affected during pipeline construction due to noise, dust, and disturbance.

An archaeologist would be retained on site during pipeline construction to assist in avoiding impacts to cultural resources. Dust would be controlled as a part of the permit for a grading plan. After pipeline construction is completed, no other impacts to significant historic cultural resources would be expected.

4.10.2.3 Red Rock Valley

Four significant prehistoric sites occur near the Red Rock Valley route. Two are located near the gas pipeline route in the Pah Rah Range. The other two are in Warm Springs Valley and Winnemucca Valley, which would be traversed by the gas pipeline.

The Wild Horse Spring site (CrNV-31-4261) is in a remote area, but it is adjacent to an exiting road. The gas pipeline would pass 200 feet north of this site. Nearby pipeline construction could increase access to this site and vandalism. The Cottonwood Creek site (CrNV-31-4256) is bisected by the Wilcox Ranch Road. It has been extensively looted. The gas pipeline would pass 100 feet north of this site. Pipeline construction in this area could affect the Cottonwood Creek site from increased human presence and further vandalism and looting.

Construction of the gas pipeline through Winnemucca Valley would directly affect both the Warm Springs Valley site (CrNV-31-3247) and the Winnemucca Valley site (CrNV-31-4364) because each is too large to avoid. Both sites would require testing to (1) evaluate subsurface content, (2) increase the amount of site data, and (3) develop a data-retrieval plan. Other effects to both sites include increased visits to the area and potential looting and vandalism.

Seven significant historic sites occur near the Red Rock Valley route. All are located in Olinghouse Canyon within several hundred feet of the proposed route of the gas pipeline. Even though the gas pipeline right-of-way would be narrower in this area, as well as maneuvered to avoid these resources, all seven sites would be temporarily affected during pipeline construction due to noise, dust, and disturbance.

An archaeologist would be retained on site during pipeline construction to assist in avoiding impacts to cultural resources. Dust would be controlled as a part of the permit for a grading plan. After pipeline construction is completed, no other impacts to significant historic cultural resources would be expected.

4.10.3 No Action Alternative

Under no action, the rights-of-way would be denied. No impacts would occur to cultural resources along the pipeline routes. Impacts to cultural resources in Honey Lake Valley would not occur. The owners of Fish Springs Ranch would retain the rights to approximately 14,000 acre-ft of water, some portion of which would presumably be put to beneficial use. Impacts to cultural resources from the use of this water are unknown.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.10.3.1 Supply Side Sub-Alternative

Additional groundwater pumping in the Truckee Meadows under this sub-alternative would have unknown impacts to cultural resources because the locations of the four new wells to be pumped are not known. Site-specific archaeological surveys would be required to determine the existence of archaeological resources at these well sites. This sub-alternative also includes the acquisition of 6,900 acre-ft/yr of Truckee River irrigation rights and their conversion to municipal and industrial uses. This would have no impacts on cultural resources.

Under this sub-alternative, the population in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows would grow by 35,400 people between 1995 to 2015. These people would require about 4,300 acres of land for residential and commercial developments. Disturbance of cultural resources in these areas could occur through vandalism associated with a growing population. Procedures are in place in Washoe County to protect cultural resources discovered in the path of development (Washoe County, 1991a; Washoe County, 1991b; Truckee Meadows Regional Planning Agency, 1991).

4.10.3.2 Demand Side Sub-Alternative

Conservation of water in the Reno-Sparks metropolitan area would have no impacts on cultural resources.

4.10.3.3 Negotiated Settlement Sub-Alternative

The effects on cultural resources from acquiring water from the negotiated settlement are unknown because the details of this sub-alternative with regard to surface disturbances are unknown.

Under this sub-alternative, the population in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows would grow by 139,300 people between 1995 to 2015. These people would require about 16,300 acres of land for residential and commercial developments. Disturbance of cultural resources in these areas could occur through vandalism associated with a growing population. Procedures are in place in Washoe County to protect cultural resources discovered in the path of development (Washoe County, 1991a; Washoe County, 1991b; Truckee Meadows Regional Planning Agency, 1991).

4.11 RECREATION

4.11.1 Proposed Action

4.11.1.1 Direct Impacts

Issuance of the rights-of-way by the BLM would have no direct impact on the physical character of established or commonly-used recreation areas. Construction-related equipment, noise, and dust could adversely impact some ORV users and cause a temporary reduction of recreational use in the vicinity of active construction. The severity of these impacts, considering that they would occur only in the vicinity of widely separated construction areas, is judged to be minor. Other recreational activities such as hiking, horseback riding, target shooting, and hunting would be largely unaffected.

Roads associated with pipeline construction and operation could increase public accessibility to areas that now have limited access. Most of the potentially impacted areas lie at the northern end of the proposed route in the vicinity of Dry Valley and Dry Valley Creek, and in parts of the Pah Rah Range between Olinghouse Canyon and Warm Springs Valley along the proposed route of the gas pipeline. The additional roads created by construction of the pipelines could enhance access to public lands.

4.11.1.2 Indirect Impacts

- *Water Source Area*

Over the course of a 100 years, drawdown of the water table in Honey Lake Valley could reduce phreatophytic vegetation. This could reduce the recreational potential of the valley for activities such as hunting and sightseeing. Because hunting and sightseeing activities are limited in eastern Honey Lake Valley, the overall impacts on recreation from diminished phreatophytic vegetation in this area are judged to be minor.

Effects on recreation in the Skedaddle Mountains *wilderness study area* (WSA) and the Dry Valley Rim WSA are also judged to be negligible. Springs in these WSAs discharge at

elevations that are many hundreds to more than a thousand feet higher than the elevation of the water table. These springs would therefore be unaffected by the projected drawdown of the regional water table in these WSAs (see Section 4.4). Furthermore, vegetation in these WSAs is not dependent on groundwater. Hence, wildlife in these WSAs that supports hunting would not be expected to be adversely impacted by planned pumping at Fish Springs Ranch.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population. These people would require additional forms of structured recreational opportunities such as golf courses, softball fields, tennis and basketball courts, and swimming pools. The impacts on nearby unstructured recreational opportunities that rely on natural settings could include degradation from overuse, littering, and vandalism.

4.11.2 Alternative Routes

The direct impacts to recreation from selection of any of the alternative pipeline routes would be similar to the proposed routes. Briefly, construction-related equipment, noise, and dust could adversely impact some ORV users and cause a temporary reduction of recreational use in the vicinity of active construction. The severity of these impacts, considering that they would occur only in the vicinity of widely separated construction areas, is judged to be minor. Other recreational activities such as hiking, horseback riding, target shooting, and hunting would be largely unaffected.

Roads associated with pipeline construction and operation could increase public accessibility to areas that now have limited access. The additional roads created by construction of the pipelines could enhance ORV travel, but at the expense of wildlife, surface waters, archaeological resources, and other resources in these currently remote areas.

The indirect impacts that would occur to recreational opportunities in the water source area and in Lemmon Valley and Spanish Springs Valley from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. These impacts include degradation of remote recreational areas from overuse, littering, and vandalism due to a growing metropolitan area. At the same time, however, the growing population would require additional forms of structured recreational opportunities including golf courses, softball fields, tennis and basketball courts, and swimming pools.

4.11.3 No Action Alternative

Under the no action alternative, groundwater pumping for irrigation purposes would continue at Fish Springs Ranch. Recreational sites and opportunities on BLM lands would not be impacted. Improved access to currently remote areas along the proposed routes of the pipelines would not occur.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.11.3.1 Supply Side Sub-Alternative

Population growth supported by this sub-alternative from 1995 to 2015 could amount to an additional 12,700 people in Lemmon and Spanish Springs Valleys and an additional 22,700 people in the Truckee Meadows. Adverse impacts to nearby unstructured recreational opportunities, such as littering and vandalism, would likely occur due to this growth. The availability of structured recreational opportunities in the metropolitan area would presumably be commensurate with the population growth projected under this sub-alternative.

4.11.3.2 Demand Side Sub-Alternative

Water conservation in the metropolitan area could benefit urban parks and golf courses simply by stretching the available water resources. Also, minimizing the use of Truckee River water would benefit the river which offers the community many recreational opportunities such as sight-seeing, hunting, fishing, and rafting.

4.11.3.3 Negotiated Settlement Sub-Alternative

Population growth supported by this sub-alternative from 1995 to 2015 could amount to an additional 139,300 people in the metropolitan area. Adverse impacts to nearby unstructured recreational opportunities, such as littering and vandalism, would likely occur due to this growth. The availability of structured recreational opportunities in the area would presumably be commensurate with the population growth projected under this sub-alternative.

4.12 LIVESTOCK GRAZING

4.12.1 Proposed Action

4.12.1.1 Direct Impacts

Figure 3.12-1 shows the grazing allotments affected by the proposed pipeline routes. About 940 acres of rangeland would be disturbed during pipeline construction. All but 140 acres for the access road along the length of the pipelines would be reclaimed. Long-term impacts to grazing would be minor from the loss of 140 acres of forage distributed over many allotments along a 15-foot-wide road.

Cattle tend to use low-lying areas near permanent water, rather than areas with steep topography and long travel distances to water. Pipeline construction in low-lying areas could

impact access to some water sources. Stress created by the noise and disturbance of heavy-equipment operation could also impact some cattle that are not habituated to these activities. Weight loss and even mortality could result, but a cause-and-effect relationship would be very difficult to prove with any certainty. Some increased vehicle mortality could also be expected on open range due to the increased number of vehicles traveling to and from construction sites early in the morning and late in the day. Washoe County proposes to coordinate construction schedules with grazing operations on a case-by-case basis in consultation with the BLM and their grazing permittees.

Cattle need daily access to water during the summer months (Wolfe, 1991). Over the nine-month course of pipeline construction, adverse impacts to cattle seeking water could occur anywhere along the pipeline routes. At any one time, however, a total of six construction crews would be working along widely separated segments of the water and gas pipelines. Each construction zone would be less than a quarter-mile long. The severity of these construction-related impacts depends largely on the ability to coordinate grazing management (such as rotation systems) with construction schedules. After the pipelines are emplaced, Washoe County would restore and/or replace all affected range improvements to pre-construction conditions.

Grazing allotments potentially affected by construction along the proposed route of the water pipeline include Flanigan, Winnemucca Ranch, Antelope Mountain, Red Rock, and Paiute Canyon. Olinghouse Canyon is the only additional allotment that would be affected by construction of the gas pipeline.

Improved access provided by construction and maintenance roads could result in occasional conflicts between recreational users of public lands and livestock operators.

4.12.1.2 Indirect Impacts

- *Water Source Area*

Drawdown of groundwater in Honey Lake Valley could reduce shrub cover on the Flanigan allotment (Figure 4.12-1). The amount and significance of forage reduction on this allotment are difficult to estimate. The greatest impact to forage production is expected to occur in low lying areas of the allotment where greasewood predominates. Greasewood, however, has limited palatability for cattle and a reduction in greasewood could result in an increase of more palatable grass species. Considering that the impact to this vegetation would occur over the course of 100 years, that the area has low productivity due to aridity, and that this vegetation is not crucial to cattle, long-term impacts to livestock operations are expected to be negligible. Although other allotments shown on Figure 4.12-1 would also be affected by drawdown of the water table, no impacts are projected to occur to vegetation in these allotments (see Sections 4.3 and 4.6).

Stock-watering wells in Honey Lake Valley could be adversely affected by lowering of the groundwater table. Also, the *artesian* flow of wells in the southwestern Smoke Creek Desert could be decreased, which could reduce the supply of water for livestock.

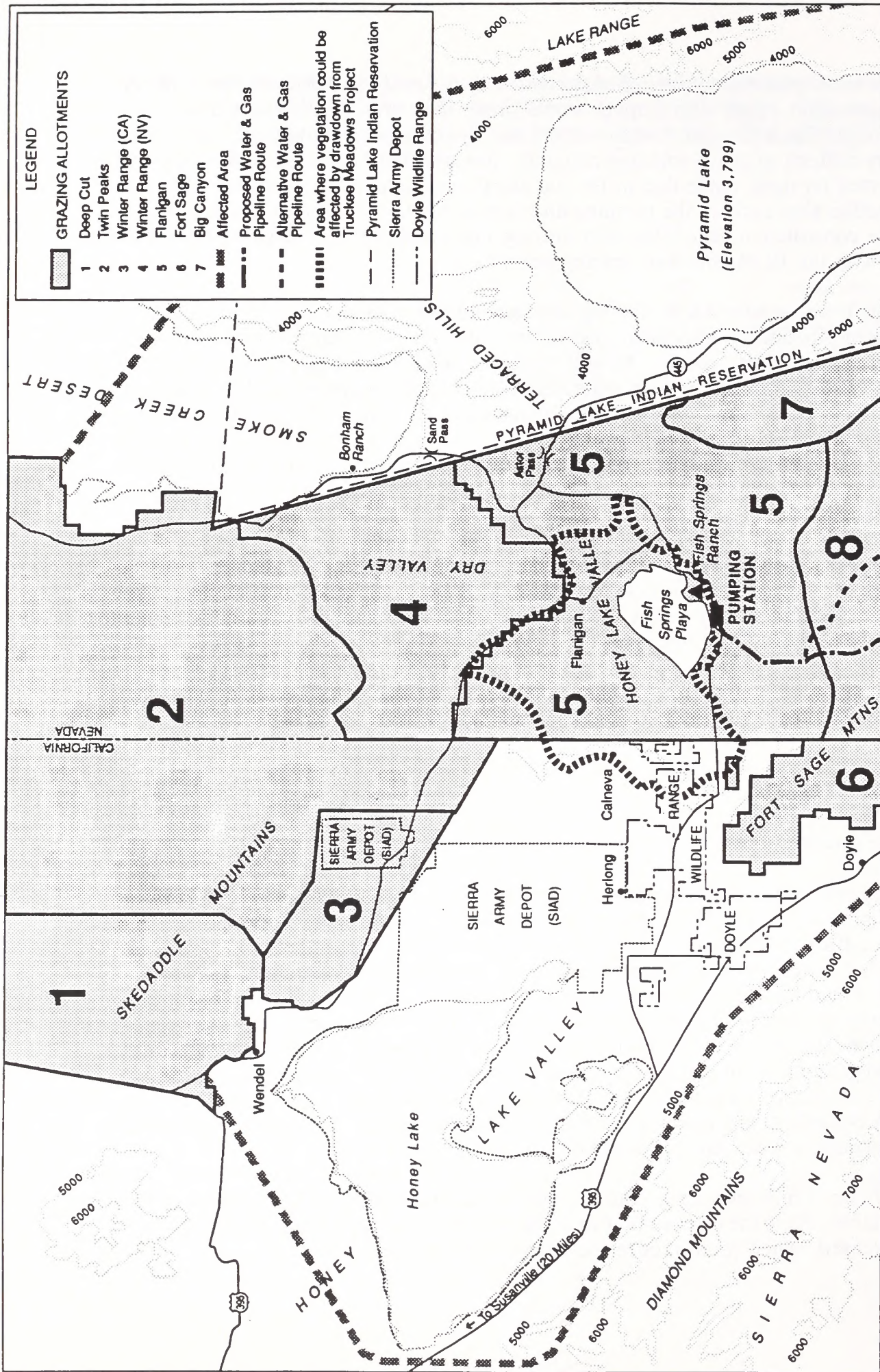


Figure 4.12-1

Grazing Allotments in Water Source Area where Drawdown of Water Table could Affect Vegetative Cover

AFFECTED AREA

0 2 4 MILES

Contour Interval = 1,000 Ft

About 1,400 acres of irrigated fields at Fish Springs Ranch would be taken out of production as the rate of groundwater pumping increases at the well field. This would reduce hay production from the local area that is now used for wintering cattle and domestic horses.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

Population growth would lead to increased use of, and demands on, public lands in the Paiute Canyon, Red Rock, Antelope Valley, and Spanish Springs-Mustang allotments. This would likely cause increased conflicts with livestock operators and difficulties with range management.

4.12.2 Alternative Routes

The indirect impacts that would occur to livestock grazing in the water source area and in Lemmon Valley and Spanish Springs Valleys from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. Briefly, these impacts include the potential to reduce the forage availability for livestock on the Flanigan allotment over an estimated 13,000 acres in Honey Lake Valley. About 1,400 acres of irrigated fields at Fish Springs Ranch would also be taken out of production as the rate of groundwater pumping from Honey Lake Valley increases. Population growth in the Reno-Sparks metropolitan area indirectly associated with any of the alternative pipeline routes could increase conflicts between private landowners, wild horses, and recreational users of public lands.

4.12.2.1 Winnemucca Valley

This alternative route would disturb 928 acres of rangeland; 85 percent of the disturbed land would be reclaimed. Bedell Flat would be avoided under this alternative. Grazing allotments affected by pipeline construction would include the Flanigan, Winnemucca Ranch, Paiute Canyon, and Olinghouse Canyon.

Pipeline construction in low-lying areas along this route could reduce access to some water sources. Stress created by the noise and disturbance of heavy-equipment operation could also impact some cattle that are not habituated to these activities. Weight loss and even mortality could result, but a cause-and-effect relationship would be difficult to prove with certainty. Increased vehicle mortality could also be expected on open range due to the increased number of vehicles traveling to and from construction sites early in the morning and late in the day.

Over the nine-month course of pipeline construction, adverse impacts to cattle seeking water could occur anywhere along the pipeline route. The severity of these construction-related

impacts depends largely on the ability to coordinate grazing management (such as rotation systems) with construction schedules. Washoe County proposes to coordinate construction schedules with grazing operations.

4.12.2.2 Antelope Valley

This alternative route would disturb 959 acres of rangeland; 85 percent of the disturbed land would be reclaimed. Grazing allotments affected by pipeline construction would include Flanigan, Winnemucca Ranch, Antelope Mountain, Paiute Canyon, Red Rock, and Olinghouse Canyon. The Red Rock allotment is one of the smallest allotments in the affected area. Even so, the amount of land that would be permanently disturbed in the Red Rock allotment by this alternative route is estimated to be only 0.1 percent of the total area of the allotment.

Pipeline construction in low-lying areas along this route could reduce access to some water sources. Stress created by the noise and disturbance of heavy-equipment operation could also impact some cattle that are not habituated to these activities. Weight loss and even mortality could result, but a cause-and-effect relationship would be difficult to ascertain with certainty. Some increased vehicle mortality could also be expected on open range due to the increased number of vehicles traveling to and from construction sites early in the morning and late in the day.

Over the nine-month course of pipeline construction, adverse impacts to cattle seeking water could occur anywhere along the pipeline route. The severity of these construction-related impacts depends largely on the ability to coordinate grazing management (such as rotation systems) with construction schedules. Washoe County proposes to coordinate construction schedules with grazing operations.

4.12.2.3 Red Rock Valley

This alternative route would disturb 1,179 acres of rangeland; 85 percent of the disturbed land would be reclaimed. Bedell Flat would be avoided under this alternative. Grazing allotments affected by pipeline construction would include Flanigan, Winnemucca Ranch, Paiute Canyon, Antelope Mountain, and Olinghouse Canyon.

Pipeline construction in low-lying areas along this route could reduce access to some water sources. Stress created by the noise and disturbance of heavy-equipment operation could also impact some cattle that are not habituated to these activities. Weight loss and even mortality could result, but a cause-and-effect relationship would be difficult to prove with certainty. Some increased vehicle mortality could also be expected on open range due to the increased number of vehicles traveling to and from construction sites early in the morning and late in the day.

Over the nine-month course of pipeline construction, adverse impacts to cattle seeking water could occur anywhere along the pipeline route. The severity of these construction-related impacts depends largely on the ability to coordinate grazing management (such as rotation

systems) with construction schedules. Washoe County proposes to coordinate construction schedules with grazing operations.

4.12.3 No Action Alternative

Under the no action alternative, groundwater pumping for irrigation purposes would continue at Fish Springs Ranch. No impacts to livestock grazing would occur in the water source area or along the proposed pipeline routes.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.12.3.1 Supply Side Sub-Alternative

The conversion of Truckee River irrigation rights to municipal and industrial uses, and the use of additional groundwater supplies, would have no impact on livestock grazing.

4.12.3.2 Demand Side Sub-Alternative

Water conservation by future residents in the Reno-Sparks metropolitan area would have no impact on livestock grazing.

4.12.3.3 Negotiated Settlement Sub-Alternative

Under this sub-alternative, an additional 139,300 people would be supported in the Reno-Sparks metropolitan area by the year 2015. This growth would increase the use of public lands, which could conflict with livestock grazing and force some permittees to reduce or remove livestock from their grazing allotments.

4.13 MINERALS

4.13.1 Proposed Action

4.13.1.1 Direct Impacts

Construction of the pipelines would require the use of sand and gravel. These materials could be acquired by Washoe County from public lands at locations yet to be identified along or near the rights-of-way. This mining activity is an irretrievable commitment of resources.

The proposed action does not require the withdrawal of any public lands from entry under the mining laws. Nor would the proposed action impact any existing mining operations on public land. Mineral exploration and development on public lands would therefore not be

affected by issuance of the rights-of-way. The Sha-Neva sand pit located about a half mile west of the water-storage tank site in Lemmon Valley is on private land. Pipeline construction that might affect this operation would be resolved between Washoe County and the pit operator.

Unpatented mining claims occur along the route of the gas pipeline in the Olinghouse Canyon area. Some of these claims were located after passage the Multiple Surface Use Act of July 23, 1955 (Public Law 167). In these cases, a right-of-way can be granted across the unpatented claim without permission of the mining claimant, even though the claimholder would still retain certain rights with regard to mineral exploration and development. Other unpatented claims that would be crossed in the Olinghouse Canyon area are pre-1955. In these cases, the mining claimant would have the right to deny Washoe County from crossing the claim. In the event that the right-of-way was issued, and the claim holder (either pre- or post-1955 claims) sued in court for damages due to the right-of-way, then the claimant would assume the burden of proof with regard to the validity of the claim.

Upon issuing a right-of-way grant, the BLM does not make any warranties or guarantees with respect to minerals. If the rights-of-way are issued, a statement will be included in the grant that mining claims exist along the routes.

Although a right-of-way could be free of unpatented mining claims when the grant is issued, mining claims and patents could still be filed under the 1872 mining law. If these unpatented mining claims ultimately went to patent, the federal government would no longer have jurisdiction over the land. The right-of-way holder, however, would not have to obtain permission for use of the patented land from the patent holder, but a fee for use of the patented land would likely be charged by the patent holder.

In summary, issuance of the rights-of-way would have no direct impacts on mineral exploration or development on public lands either now or in the foreseeable future.

4.13.1.2 Indirect Impacts

Issuance of the rights-of-way would have no indirect impacts on mineral exploration or development.

4.13.2 Alternative Routes

The impacts to mineral resources from the selection of any of the alternative routes would be similar to those described for the proposed action; that is, no direct or indirect impacts would occur to mineral exploration or development on public land.

4.13.3 No Action Alternative

Under the no action alternative, the BLM would deny Washoe County the rights-of-way for the proposed pipelines. Groundwater pumping for irrigation purposes would continue at

Fish Springs Ranch at current levels. This action would have no impacts on mineral exploration or development.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. In this EIS, the impacts of the supply side, demand side, and negotiated settlement water-supply options are analyzed. Implementation of one or all of the three sub-alternatives would have no impacts on mineral exploration or development.

4.14 LAND USE

4.14.1 Proposed Action

4.14.1.1 Direct Impacts

Refer to Figure 3.14-1 for the location of lands discussed in this section.

The proposed rights-of-way are consistent with the objectives of BLM land-use planning. BLM policies, plans, and programs for rights-of-way are outlined in the Lahontan Resource Management Plan (LRMP; BLM, 1984). The LRMP identifies right-of-way corridors intended to minimize the proliferation of dispersed rights-of-way. The primary intent of designating these corridors is to minimize environmental impacts from major overhead powerlines. The LRMP does not restrict underground pipelines to specific right-of-way corridors.

The LRMP designates Bedell Flat and Dry Valley for roaded, general recreational opportunities. It limits rights-of-way in Bedell Flat and Dry Valley to those that do not alter the present undeveloped character of these valleys. During construction of the proposed pipelines, Bedell Flat and Dry Valley would be affected, but this impact would be temporary. Prompt reclamation would ensure that the long-term undeveloped character of these valleys would be maintained. The right-of-way, however, would require disturbance of a two-mile segment of a currently un-roaded and undisturbed area at the northern end of Dry Valley.

Effects on traditional uses of public and private lands such as recreation, grazing, and mining would be minor and short-term from construction of the proposed water and gas pipelines. At any one time, traditional land-use practices would be temporarily excluded at six widely-separated construction zones. Four construction crews would operate along the water pipeline, proceeding at a pace of about 250 feet per day. Two construction crews would operate along the gas pipeline from Dodge Flat to northern Hungry Valley, proceeding at a pace of about 750 feet per day. Some public and private range improvements could be damaged by this construction. After the pipelines are emplaced, Washoe County would restore and/or replace all affected range improvements to pre-construction conditions.

The Reno-Sparks Indian Colony abuts the route of the water pipeline in Hungry Valley. About 330 people currently live in 98 houses at the Colony. Pipeline construction near the

Colony would result in increased emissions of dust, noise, and occasional traffic delays. These impacts would be short term.

The water pipeline would cross relatively few areas of private land. In contrast, the route of the gas pipeline would pass through extensive holdings of private land in Warm Springs Valley. Although the pipeline would, in most instances, pass through these private lands on county rights-of-way along existing dirt roads, pipeline construction would inevitably encroach upon private lands that could contain structures such as fences and barns. Private landowners could be inconvenienced in the short-term by dust and construction noise, as well as the trenching of driveways and access roads. Other potential short-term impacts due to construction include the removal of trees and landscaping, as well as the short-term removal of agricultural lands from production. Washoe County proposes to provide full compensation to private-property owners in the event that construction results in damage to private property.

Washoe County would negotiate with private landowners for access to and use of private lands that are needed for construction and operation of the pipelines. Eminent domain procedures could be required for access to and use of certain private lands. Long-term impacts to private land-owners, though judged to be minor, could occur from land-easement encumbrances for the operational right-of-way that would prohibit certain types of land use including above-ground structures and some types of landscaping.

4.14.1.2 Indirect Impacts

- *Water Source Area*

The projected decline of the groundwater table would be likely to have the greatest impact on land use as described in the following sections. Figure 4.14-1 shows the projected drawdown after 100 years of pumping at Fish Springs Ranch.

Public and State Lands

Traditional uses of public lands such as recreation, grazing, and mining would not be significantly affected by pumping at Fish Springs Ranch. Relatively little public land exists on the Nevada side in Honey Lake Valley where drawdown would be most pronounced.

Adverse impacts to livestock operations in the water source area are expected to be negligible. The greatest effect on forage production is expected to occur in low-lying areas in eastern Honey Lake Valley where greasewood predominates. Greasewood, however, has limited palatability for cattle and a reduction in greasewood over the course of 100 years could result in an increase in more palatable grass species.

Groundwater pumping would not be expected to impact the springs or the vegetation in either of the two *wilderness study areas* north of Honey Lake Valley (Section 4.3). Parts of both *wilderness study areas* have been recommended by the BLM as suitable for wilderness designation. Issuance of the rights-of-way would not impact the suitability of these WSAs for possible inclusion in the National Wilderness Preservation System.

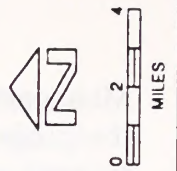
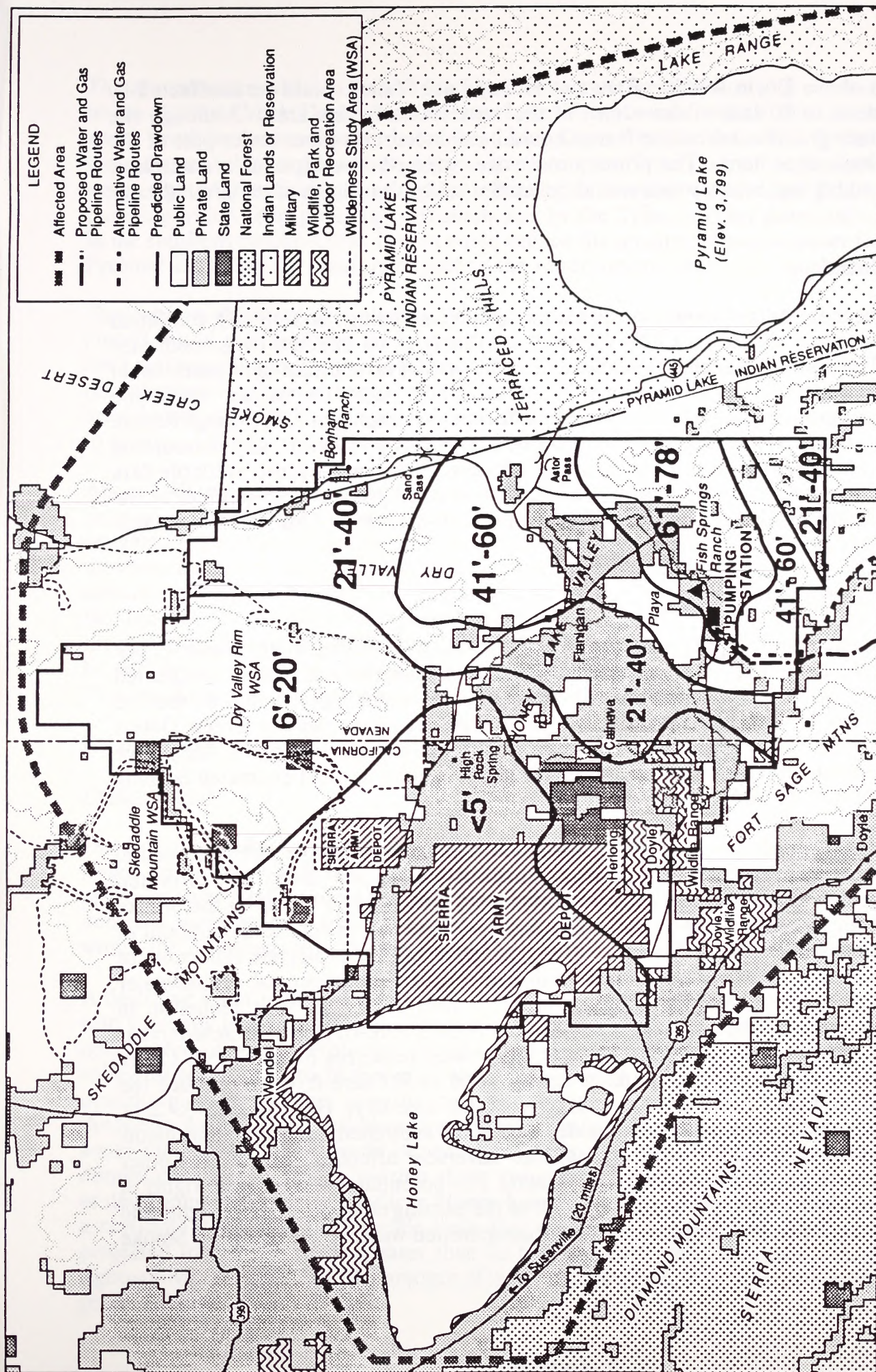
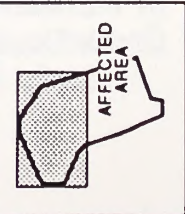


Figure 4.14-1

Maximum Predicted Drawdown in the Affected Area (in feet)



Management of the Doyle Wildlife Range in Honey Lake Valley would be unaffected by the projected six to 20 feet of drawdown of the water table in this area. Although the acreage of black greasewood on the Range could be reduced, this plant is not part of the diet of the Doyle deer herd. The primary mule deer winter-browse species are antelope bitterbrush and big sagebrush, which would be unaffected by drawdown of the groundwater table.

Sierra Army Depot

On the basis of the results of water-flow and water-quality modeling (Section 4.4), continued use and operation of the Sierra Army Depot is not likely to be affected by groundwater pumping at Fish Springs Ranch. Available data indicate that no substantial impacts would occur to the quality of groundwater supplies at the Sierra Army Depot, nor would the overall extent of groundwater contamination be affected by pumping at Fish Springs Ranch. Remediation efforts at the Depot are expected to be completed before any measurable changes in groundwater levels or movement would occur. However, because available data are limited, the potential exists for a decline in the quality of groundwater supplies at the Depot and adverse impacts to monitoring and remediation efforts. This potential is very small.

Pyramid Lake Reservation

The Pyramid Lake Paiute Tribe asserts a claim to reserved water rights in the Smoke Creek Desert within the Pyramid Lake Reservation. The Tribe's claims have not been adjudicated or quantified. The Tribe has indicated that these reserved water rights would be used to irrigate about 2,480 acres of cropland in the southern part of the Smoke Creek Desert (Stetson Engineers Inc., 1990). Consultants to the Tribe (Stetson Engineers, Inc.) have estimated that approximately 5,500 acre-ft/yr would be required to meet estimated farming requirements in the Smoke Creek Desert.

Although data on groundwater quantity in the Smoke Creek Desert are limited (see Section 3.4.2.1), the perennial yield of the Desert is estimated at 16,000 acre-ft/yr. The projected reduction in groundwater flows of 2,300 acre-ft/yr from Honey Lake Valley to the Smoke Creek Desert due to planned pumping at Fish Springs Ranch would reduce the amount of recharge to the Smoke Creek Desert. The net effect of the projected reduction of groundwater inflows to the Desert, combined with related reductions of groundwater outflows from the Desert to Pyramid Lake of 827 acre-ft/yr, would be a reduction in groundwater quantity in the Smoke Creek Desert of 1,473 acre-ft/yr (2,300 acre-ft/year minus 827 acre-ft/yr). This would decrease the total water resources in the Smoke Creek Desert from the currently estimated 16,000 acre-ft/yr to 14,527 acre-ft/yr and reduce the uncommitted resources from 9,608 acre-ft/yr to 8,181 acre-ft/yr (see Section 3.4.2.1). Sufficient groundwater would still be available to meet the estimated farming requirements on the Reservation of 5,500 acre-ft/yr without adversely affecting any of the other committed water rights in the Smoke Creek Desert. The potential reserved water rights of the Tribe would likely be senior to most if not all of the existing committed water rights and to Washoe County's pending applications for all uncommitted water resources in the Smoke Creek Desert.

The groundwater model projected that the 2,300 acre-ft/yr reduction in groundwater inflow to the Smoke Creek Desert from Honey Lake Valley would reduce the current *artesian* water level in the southwestern Smoke Creek Desert by 28 feet. This lowering of the groundwater table could have an adverse impact on the Tribe's use of its potential reserved water rights for agricultural purposes, including an increase in potential future costs for pumping water. Any pumping of groundwater by the Tribe or other potential water users in the southern Smoke Creek Desert could reduce the quantity of groundwater flowing into Pyramid Lake thereby possibly impacting the water quantity and water quality of the lake.

The *artesian* elevation of the groundwater table in the modeled part of the Smoke Creek Desert would still be above the land surface, and it would likely remain above or near the land surface throughout the southern Smoke Creek Desert. Access to groundwater by phreatophytic vegetation would be unaffected. The flow at springs and artesian wells in the area, however, could be reduced by as much as 43 percent, with potential adverse impacts to grazing, wildlife, recreation, and several wetlands on this part of the Reservation.

About 1,400 acre-ft/yr of relatively poor-quality groundwater that now enters the lake would be replaced by Washoe County with better-quality water from the Truckee River. Although any improvement in the quality of water at Pyramid Lake would be beneficial, the projected improvement from the proposed action would be insignificant because 1,400 acre-ft/yr amounts to only one-third of one percent of the average annual discharge to the lake from the Truckee River. This would have a negligible impact on Tribal operations. However, the increased flows in the lower Truckee River from the 1,400 acre-ft/yr of water that would be dedicated to the lake would have a slightly beneficial impact on the water quality of the Truckee River, as well as the wildlife that the river supports.

No other impacts would be expected to the Pyramid Lake Reservation.

Private Lands

Honey Lake Valley, Nevada, contains about 48,000 acres of private land; it is one of the larger privately owned and undeveloped land areas in Washoe County. There are approximately 1,400 property owners on the Nevada side of the valley, but only about 10 domestic wells are currently in use. There are also about 30,000 acres of private lands within the drawdown area in California.

A declining water table in Honey Lake Valley could impact land owners, particularly those who currently live near the county's planned well field and rely on domestic wells for their only source of water. Projected drawdown of the water table on the Nevada side of the valley ranges from 20 to 78 feet after about 100 years of pumping. In California, projected drawdown is six to 20 feet near the state line, and decreases to zero along the west side of the Sierra Army Depot. All water wells in this area would be affected by the decline in the water table. The result would be increased pumping costs and the potential for shallow domestic wells to go dry. Lowering of the groundwater table would also increase the costs of developing new domestic wells in Honey Lake Valley. Washoe County proposes to offer a one-time deepening of domestic wells that are within an area where the drawdown is projected in this EIS to be greater than 20 feet and that are in use on the date that the rights-of-way are granted. The amount of well deepening would be twice the amount of the projected drawdown.

The export of groundwater from Honey Lake Valley could constrain potential future development and economic growth in the valley. Without the ability to obtain additional sources of water, future development would be restricted to low-density residential housing that relies on domestic wells. Domestic wells in Nevada are allowed to pump up to 1,800 gallons per day without an appropriation permit from the Nevada State Engineer. Foregone would be the potential for commercial, industrial, and agricultural developments in the valley that require moderate to large amounts of water.

The flow of springs and artesian wells on private lands in the southwestern Smoke Creek Desert, including Bonham Ranch, could be reduced by as much as 43 percent.

Finally, the acreage of irrigated land at Fish Springs Ranch would be reduced as the rate of pumping associated with the export of water from Honey Lake Valley increases over time.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

Much of the land in Lemmon and Spanish Springs Valleys that is now vacant or in agricultural use would be rezoned to accommodate this growth. An estimated 200 acres in Lemmon Valley and 8,700 acres in Spanish Springs Valley would be converted to primarily residential and commercial uses (Table 4.14-1). Spanish Springs Valley would be the recipient of more than 90 percent of the water from Honey Lake Valley and, hence, 90 percent of the associated population. This growth would increase demands for recreational use of surrounding public lands.

The Washoe County Regional Plan identifies Spanish Springs Valley as a major focus for future growth in the area (Washoe County, 1991a). It proposes to direct growth to that area through the development of capital improvements. The proposed action would help achieve the goals of that plan by accommodating a portion of those capital improvements. It would also transform Spanish Springs Valley from its current rural setting to a suburban/urban setting.

4.14.1.3 Conclusions

Direct impacts to traditional land uses from construction and operation of the proposed pipelines would be expected to be short-term and minor.

Continued use and operation of the Sierra Army Depot is not likely to be affected by groundwater pumping at Fish Springs Ranch. There exists the slight chance, however, that the Depot's drinking water supplies could be degraded over 100 years and remediation efforts, if not completed by that time, could also be adversely affected.

Planned pumping at Fish Springs Ranch could adversely affect the use of potential reserved water rights in the Smoke Creek Desert asserted by the Pyramid Lake Paiute Tribe. The flow of springs and artesian wells in the southwestern Smoke Creek Desert could be reduced by as much as 43 percent, thereby adversely affecting grazing, wildlife, recreation, and several wetlands on this part of the Reservation. About 1,400 acre-ft/yr of poor-quality groundwater that now enters the lake would be replaced with better-quality water from the Truckee River, resulting in a slightly beneficial impact to the water quality of Pyramid Lake.

TABLE 4.14-1 LAND DISTURBANCES FROM GROWTH BETWEEN 1995-2015 FROM THE TRUCKEE MEADOWS PROJECT AND ITS ALTERNATIVES (in acres)			
Area	Truckee Meadows Project	Supply Side Sub-Alternative	Negotiated Settlement Sub- Alternative
Lemmon Valley ^(a)	200	100	200
Spanish Springs Valley ^(b)	8,700	2,400	8,700
Truckee Meadows ^(a)	0	1,800	7,400
Total	8,400	4,300	16,300
^(a) Assumes an average of five dwelling units per acre, plus 25 percent for streets and other types of land uses (commercial, industrial, etc.).			
^(b) Assumes an overall gross density of 2 dwelling units per acre; includes all land use types (commercial, industrial, etc.), plus 15 percent for streets.			

The export of groundwater from Honey Lake Valley would constrain future development and economic growth on the Nevada side of the valley. The natural flow of springs and artesian wells on private lands in the southwestern Smoke Creek Desert could be reduced by as much as 43 percent.

Growth in Lemmon and Spanish Springs Valleys would transform the character of these valleys from a rural setting to an urban/suburban setting.

4.14.2 *Alternative Routes*

The indirect impacts that would occur to land use in the water source area and in Lemmon Valley and Spanish Springs Valley from selection of any of the alternative pipeline routes would be identical to those described under the proposed Bedell Flat route. Briefly, these indirect impacts include a slight chance of drying up the Sierra Army Depot's shallow monitoring wells after 100 years of pumping at Fish Springs Ranch, along with a slight chance of degrading the Depot's drinking-water supply; possible adverse impacts to the use of reserved water rights asserted by the Pyramid Lake Paiute Tribe, as well as potential reductions in the flow of springs and artesian wells in the southwestern Smoke Creek Desert which could adversely affect grazing, wildlife, recreation, and several wetlands on this part of the Reservation; minor beneficial impacts to the water quality of Pyramid Lake and the lake's threatened and endangered fish; constraints on future development and economic growth on the Nevada side of Honey Lake Valley; and the transformation of Lemmon and Spanish Springs Valleys from a rural setting to an urban/suburban setting.

4.14.2.1 Winnemucca Valley

The Winnemucca Valley route would avoid construction in Bedell Flat. It would disturb 928 acres of land; 85 percent of the disturbed land would be reclaimed. Of these 928 acres, 357 acres would be on public land and 571 acres would be on private land. Some of the private lands along the Winnemucca Valley route support agriculture as well as low-density residential housing.

Effects on traditional uses of public and private lands from pipeline construction would be minor and short-term. At any one time, traditional land-use practices would be temporarily affected at six widely-separated construction zones. Four construction crews would operate along the water pipeline, proceeding at a pace of about 250 feet per day. Two construction crews would operate along the gas pipeline from Dodge Flat to northern Hungry Valley, proceeding at a pace of about 750 feet per day. Some public and private range improvements could be damaged by this construction. After the pipelines are emplaced, Washoe County would restore and/or replace all affected range improvements to pre-construction conditions.

From north to south, the water pipeline would cross large tracts of private land in upper Dry Valley Creek, Winnemucca Valley, and western Warm Springs Valley. The gas pipeline would pass through extensive holdings of private land in Warm Springs Valley. Although the pipelines would, in most instances, pass through these private lands on county rights-of-way along existing dirt roads, pipeline construction would inevitably encroach upon private lands that could contain structures such as fences and barns. Private landowners could be inconvenienced in the short-term by dust and construction noise, as well as the trenching of driveways and access roads. Other potential short-term impacts due to construction include the removal of trees and landscaping, as well as the short-term removal of agricultural lands from production. Washoe County intends to provide full compensation to private-property owners in the event that construction results in damage to private property.

Washoe County would negotiate with private landowners for access to and use of private lands that are needed for construction and operation of the pipelines. Eminent domain procedures could be required for access to and use of certain private lands. Long-term impacts to private land-owners, though judged to be minor, could occur from land-easement encumbrances for the operational right-of-way that would prohibit certain types of land use including above-ground structures and some types of landscaping.

4.14.2.2 Antelope Valley

The Antelope Valley route would disturb 959 acres of land; 85 percent of the disturbed land would be reclaimed. Of these 940 acres, 435 acres would be on public land and 514 acres would be on private land.

Effects on traditional uses of public and private lands from pipeline construction would be minor and short-term. At any one time, traditional land-use practices would be temporarily affected at six widely-separated construction zones. Four construction crews would operate along the water pipeline, proceeding at a pace of about 250 feet per day. Two construction crews would operate along the gas pipeline from Dodge Flat to northern Hungry Valley,

proceeding at a pace of about 750 feet per day. Some public and private range improvements could be damaged by this construction. After the pipelines are emplaced, Washoe County would restore and/or replace all affected range improvements to pre-construction conditions.

The Reno-Sparks Indian Colony abuts the route of the water pipeline in Hungry Valley. About 330 people currently live in 98 houses at the Colony. Pipeline construction near the Colony would result in increased emissions of dust, noise, and occasional traffic delays. These impacts would be short term.

The water pipeline would cross large tracts of private land in Antelope Valley. The gas pipeline would pass through extensive holdings of private land in Warm Springs Valley. Although the pipelines would, in most instances, pass through these private lands on county rights-of-way along existing dirt roads, pipeline construction would inevitably encroach upon private lands that could contain structures such as fences and barns. Private landowners could be inconvenienced in the short-term by dust and construction noise, as well as the trenching of driveways and access roads. Other potential short-term impacts due to construction include the removal of trees and landscaping, as well as the short-term removal of agricultural lands from production. Washoe County intends to provide full compensation to private-property owners in the event that construction results in damage to private property.

Washoe County would negotiate with private landowners for access to and use of private lands that are needed for construction and operation of the pipelines. Eminent domain procedures could be required for access to and use of certain private lands. Long-term impacts to private land-owners, though judged to be minor, could occur from land-easement encumbrances for the operational right-of-way that would prohibit certain types of land use including above-ground structures and some types of landscaping.

4.14.2.3 Red Rock Valley

The Red Rock Valley route would avoid Bedell Flat by routing the water pipeline through Red Rock Valley and the gas pipeline through Winnemucca Valley. This route would disturb 1,179 acres of land; 85 percent of the disturbed land would be reclaimed. Of these 1,179 acres, 406 acres would be on public land and 773 acres would be on private land.

Effects on traditional uses of public and private lands from pipeline construction would be minor and short-term. At any one time, traditional land-use practices would be temporarily affected at six widely-separated construction zones. Four construction crews would operate along the water pipeline, proceeding at a pace of about 250 feet per day. Two construction crews would operate along the gas pipeline from Dodge Flat to northern Hungry Valley, proceeding at a pace of about 750 feet per day. Some public and private range improvements could be damaged by this construction. After the pipelines are emplaced, Washoe County would restore and/or replace all affected range improvements to pre-construction conditions.

The water pipeline would cross large tracts of private land in Red Rock Valley. Red Rock Valley contains numerous developed parcels and vacant private lands which would be

disrupted during pipeline construction and subsequent operation and routine maintenance. The gas pipeline would pass through extensive holdings of private land in Warm Springs Valley. Although the pipelines would, in most instances, pass through these private lands on county rights-of-way along existing dirt roads, pipeline construction would inevitably encroach upon private lands that could contain structures such as fences and barns. Private landowners could be inconvenienced in the short-term by dust and construction noise, as well as the trenching of driveways and access roads. Other potential short-term impacts due to construction include the removal of trees and landscaping, as well as the short-term removal of agricultural lands from production. Washoe County intends to provide full compensation to private-property owners in the event that construction results in damage to private property.

Washoe County would negotiate with private landowners for access to and use of private lands that are needed for construction and operation of the pipelines. Eminent domain procedures could be required for access to and use of certain private lands. Long-term impacts to private land-owners, though judged to be minor, could occur from land-easement encumbrances for the operational right-of-way that would prohibit certain types of land use including above-ground structures and some types of landscaping.

4.14.3 No Action Alternative

If the rights-of-way are not issued, land use along the pipeline routes would be unaffected. The owners of Fish Springs Ranch would retain the rights to approximately 14,000 acre-ft of water, some portion of which would presumably be put to beneficial use.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed in the following sections as no action sub-alternatives.

4.14.3.1 Supply Side Sub-Alternative

Low-density residential development for 12,700 people would continue in Lemmon and Spanish Springs Valleys from 1995-2015 under this sub-alternative. Population growth would require development of about 2,400 acres of land in Lemmon and Spanish Springs Valleys. This sub-alternative would supply water for about 22,700 people in the Truckee Meadows, disturbing about 1,800 acres.

Growth associated with this sub-alternative would continue the urbanization of Lemmon and Spanish Springs Valleys, as well as the Truckee Meadows. Some of the land in Spanish Springs Valley that is now vacant or in agricultural use would be rezoned to accommodate growth. Irrigated lands in the Truckee Meadows would gradually be taken out of production as active irrigation rights are converted to municipal and industrial uses.

4.14.3.2 Demand Side Sub-Alternative

Water conservation would have negligible impacts on land use or land-use patterns in the Reno-Sparks metropolitan area.

4.14.3.3 Negotiated Settlement Sub-Alternative

Between 1995 and 2015 an additional 46,500 people would be supported in Lemmon and Spanish Springs Valleys using water from the negotiated settlement. About 8,700 acres of land in Spanish Springs Valleys and 200 acres of land in Lemmon Valley that are now vacant or in agricultural use would be rezoned to accommodate this growth. Population growth in the Truckee Meadows from 1995 to 2015 would be about 92,800 people and would require some 7,400 acres of land.

Growth associated with this sub-alternative would continue the urbanization of Lemmon and Spanish Springs Valleys, as well as the Truckee Meadows. Much of the land in Spanish Springs Valley that is now vacant or in agricultural use would be rezoned to accommodate growth. Irrigated lands in the Truckee Meadows would gradually be taken out of production as active irrigation rights are converted to municipal and industrial uses.

4.15 SOCIOECONOMICS

4.15.1 Proposed Action

4.15.1.1 Direct Impacts

Approximately 190 workers would be required to construct the pipelines. Some construction workers would come from the local labor force and would reside in the Reno-Sparks metropolitan area. These workers and their families would benefit from the employment provided, as would the local economy from purchases of goods and services by these workers and their families. In addition, some local material suppliers and engineering firms would benefit from contracts awarded by Washoe County for work on the pipelines. Direct economic benefits from this project are small, however, when compared to the total income and labor force in Washoe County and the construction industry as a whole.

4.15.1.2 Indirect Impacts

• Water Source Area

Land owners on the California side of Honey Lake Valley could continue to develop agricultural lands so long as groundwater of suitable quality is economically available. Projected drawdown of the water table in California would range from zero to 20 feet (Section 4.4). On the Nevada side of the valley, future water appropriations by anyone other than Washoe County are unlikely. Drawdown in this area would range from 78 feet near the well field at Fish Springs Ranch to about 20 feet near the California border. Washoe County would offer a one-time deepening of domestic wells that are within the area

where drawdown is predicted to be greater than 20 feet and that are in use on the date that the rights-of-way are granted. The amount of well deepening would be twice the amount of projected drawdown. About 10 domestic wells are currently active on the Nevada side of the valley. There could be some increased costs to current and future landowners in the valley from drilling or deepening wells where the water table is projected to drop less than 20 feet.

The export of groundwater from Honey Lake Valley could reduce property values. This could occur from development limitations created by the lack of water available for development in the valley, and because Honey Lake Valley could ultimately be viewed as a "water shed" for the Reno-Sparks metropolitan area. Reduced vegetative cover on private lands could also lower land values. These impacts would be more severe on the Nevada side of the valley where drawdown is projected to be greatest.

- *Delivery/Use Area*

Population forecasts by Washoe County indicate that an additional 46,500 people would settle in Lemmon and Spanish Springs Valleys between 1995 and 2015. The proposed rights-of-way would accommodate some of the facilities that are necessary to provide water for this growth. Water supply is one component of the infrastructure needed to support this population.

Considerable disagreement exists as to whether a water development project such as the *Truckee Meadows Project* merely permits growth to occur or whether it actually induces growth. While it is recognized that no area can grow without adequate water supplies, it does not necessarily follow that the availability of water alone would guarantee that growth occurs. Population and economic growth are determined by a multitude of interrelated economic, social, political, and resource factors.

The socioeconomic consequences of this growth would nevertheless be substantial: a large satellite community in Spanish Springs Valley would be created near the Truckee Meadows over a period of 20 years. At 2.5 people per unit, this growth would require 18,600 new housing units in Lemmon and Spanish Springs Valleys.

Of the total 46,500 people, 43,600 people are projected to settle in Spanish Springs Valley by 2015. This growth would cause a substantial increase in the demand for housing, schools, health care, and public safety, especially considering that the forecasted growth rate in Spanish Springs Valley would greatly exceed peak historic growth rates in the region. Moreover, capital-improvement projects, such as the construction of a wastewater treatment facility in Spanish Springs Valley, could also be required. These impacts, some beneficial and some adverse depending on one's perspective, would be substantial but also expected because the land use designations in the master plan for this valley accommodate this growth (Washoe County, 1991a).

About 2,900 of the 46,500 people are projected to settle in Lemmon Valley by 2015. The combined wastewater-treatment capacity currently remaining at the two treatment facilities in Lemmon Valley is sufficient to support these people. The Lemmon Valley wastewater treatment facility has a remaining capacity to support about 660 people; the Reno-Stead wastewater treatment facility could support an additional 5,750 people.

Maintaining the area's quality of life is a primary concern of many Washoe County residents. The adoption of "Quality of Life Indicators" is one of twelve major policy initiatives recommended in the Truckee Meadows Regional Plan. Most quality of life concerns expressed during the scoping process for this EIS were related to the impacts of growth on the area's air quality and traffic congestion.

The Truckee Meadows is currently not in attainment with national emission standards for particulate matter (PM₁₀) and carbon monoxide (Sections 3.2 and 4.2). All of Washoe County is currently not in attainment with national standards for ozone. The major sources of these pollutants are motor vehicles and residential wood-burning. The area is soon expected to reach and maintain attainment with carbon monoxide and ozone standards. However, the Truckee Meadows is not expected to reach attainment with PM₁₀ standards by 1994 (Washoe County District Health Department, 1992a). Consequently, the Truckee Meadows will probably be designated as a *serious* nonattainment area for PM₁₀ which will require more stringent methods to control these emissions.

Population growth in Lemmon and Spanish Springs Valleys would result in an increase in vehicle trips to the Truckee Meadows from residents in Lemmon and Spanish Springs Valleys, as well as vehicle trips to Lemmon and Spanish Springs Valleys from the Truckee Meadows. Therefore, population growth in Lemmon and Spanish Springs Valleys would contribute to the PM₁₀ emissions problem in the Truckee Meadows. Based *solely* on this air quality criterion, the quality of life for residents in the metropolitan area would decline as a result of the proposed action.

Between 1995 and 2015, daily average *vehicle miles travelled* (VMT) in the Truckee Meadows is expected to increase by about 2,500,000 from an estimated 1995 level of 4,700,500 VMT. Approximately 23 percent of this increase, or 582,700 VMT, is indirectly attributed to the proposed action from people in Lemmon and Spanish Springs Valleys who travel to and from the Truckee Meadows and from people in the Truckee Meadows who travel to and from Lemmon and Spanish Springs Valleys. Based *solely* on this traffic congestion criterion, the quality of life for residents in the metropolitan area would decline as a result of the proposed action.

Regardless of the measures undertaken to preserve the area's current quality of life, residential growth and development inevitably transform rural/semi-rural areas into more urbanized and suburban settings. Rural and semi-rural suburban settings are highly valued by certain individuals because in this setting they are removed from the pressures of commercial and industrial life. The impersonal, complex pressures of urban life are diminished in rural settings (BLM, 1982). For current residents who value rural settings, the continual urbanization of Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows would detract from their quality of life.

• *Fiscal Impacts*

The *Truckee Meadows Project* has been subject to several decision points. The most significant of which were Washoe County's decision to proceed with the project and the Nevada State Engineer's decision, as amended, to approve the export of water from Honey Lake Valley. Grants for the proposed rights-of-way are among a number of additional approvals needed for the project. Overall fiscal impacts of the project could be attributed

to any one or all of these decision points. Because Washoe County is ultimately responsible for the project's funding, the county's decision to proceed with the project could be considered the crucial decision in regards to fiscal impacts. Furthermore, the primary purpose of this EIS is to analyze *environmental* impacts in compliance with the National Environmental Policy Act. Nevertheless, because the decision on the proposed rights-of-way is one of many *go/no go* decisions, fiscal impacts of the project are analyzed below.

Financing for the project's physical facilities is expected to be obtained through the State Board for Financing Water Projects (Nevada Revised Statutes 349.935 to 349.961). Through a combination of hook-up fees and monthly water charges, water customers in the service area would pay for total costs, including the financing of capital costs, annual operation and maintenance of facilities, monitoring, and depreciation expenses. Total capital costs, which includes the cost of water rights and all facilities and equipment required to deliver the water to Lemmon and Spanish Springs Valleys, are estimated at \$115,500,000 (Table 2-5). Financing costs are estimated at \$148,500,000. When the project reaches its pumping limit of 13,000 acre-ft/yr in 2015, operating costs are estimated at \$2,000,000 annually for items such as fuel, disinfectant, hydrological monitoring, and labor. All cost estimates were provided by Washoe County.

The *Truckee Meadows Project* would support a total population of 46,500 in Lemmon and Spanish Springs Valleys. The financial liability of the project rests with the taxpayers of Washoe County until a sufficient customer base is achieved in these valleys. This level of growth must occur in order for the project to be financially viable.

4.15.2 *Alternative Routes*

The direct socioeconomic impacts from pipeline construction and operation along any of the alternative pipeline routes would be similar to the direct impacts along the proposed route. These impacts include employment of about 190 construction workers who, along with their families, would benefit from the employment provided. The local economy, some local material suppliers, and some local engineering firms could also benefit.

The indirect socioeconomic impacts in the water source area and in Lemmon and Spanish Springs Valley from selection of any of the alternative routes would be identical to those described under the proposed route. Briefly, these impacts include the inability to secure new water rights on the Nevada side of Honey Lake Valley, thereby limiting future commercial development to low-density housing, as well as a potential reduction in property values, especially on the Nevada side of the valley where drawdown of the water table is projected to be greatest.

Adverse impacts to the quality of life of existing residents in Lemmon Valley, Spanish Springs Valley, and in the Truckee Meadows, could occur from increased emissions of PM₁₀, increased traffic congestion, and the continued urbanization of the metropolitan area.

4.15.2.1 Winnemucca Valley

The total capital cost associated with this route alternative, including water rights and all facilities necessary to delivery the water to Lemmon and Spanish Springs Valleys, is estimated at \$90,000,000. This estimate was provided by Washoe County and it does not include financing. Operating costs, which includes monitoring, are estimated at \$2,000,000 annually by 2015.

The Winnemucca Valley route is sparsely populated. There are currently 15 dwellings in Winnemucca Valley (data from Washoe County Department of Comprehensive Planning). The potential availability of water and natural gas to homeowners and landowners in Winnemucca Valley, although not part of the proposed action, could increase the desirability of the valley as a place to live. Homeowners in Winnemucca Valley now rely on relatively expensive propane for heating purposes.

4.15.2.2 Antelope Valley

The total capital cost associated with this route alternative, including water rights and all facilities necessary to delivery the water to Lemmon and Spanish Springs Valleys, is estimated at \$87,000,000. This estimate was provided by Washoe County and it does not include financing. Operating costs, which includes monitoring, are estimated at \$2,000,000 annually by 2015.

The Antelope Valley route is sparsely populated. There are currently 20 dwellings in Antelope Valley (data from Washoe County Department of Comprehensive Planning). The potential availability of water to homeowners and landowners in Antelope Valley, although not part of the proposed action, could increase the desirability of the valley as a place to live.

4.15.2.3 Red Rock Valley

The total capital cost associated with this route alternative, including water rights and all facilities necessary to delivery the water to Lemmon and Spanish Springs Valleys, is estimated at \$92,000,000. This estimate was provided by Washoe County and it does not include financing. Operating costs, which includes monitoring, are estimated at \$2,000,000 annually by 2015.

There are almost 100 dwellings in Red Rock Valley (data from the Washoe County Department of Comprehensive Planning). The potential availability of water to homeowners and landowners in Red Rock Valley could increase the desirability of the valley as a place to live.

4.15.3 No Action Alternative

Under the no action alternative, the rights-of-way would be denied. Washoe County taxpayers would lose the non-refundable portion of the \$2,500,000 option paid for water

rights at Fish Springs Ranch. The county would also lose all of its on-site improvements, chiefly monitoring wells, which the county has installed at Fish Springs Ranch, with an estimated value of \$1,000,000. The county's applications for additional water rights in Honey Lake Valley, together with other project assets, could be transferred to private interests. The ultimate disposition of all county investments in the *Truckee Meadows Project* is not fully known at this time.

Under no action, socioeconomic impacts would not occur along the pipeline routes or in the water source area. Employment opportunities for construction of the project would not occur, nor would local material suppliers and engineering firms benefit from contracts awarded by Washoe County for work on the project.

Selection of the no action alternative would result in the implementation of other water-management options by Washoe County and other water purveyors. The supply side, demand side, and negotiated settlement options are therefore analyzed as no action sub-alternatives. The supply options include the supply side and negotiated settlement sub-alternatives. Each would supply the community with different amounts of water. As indicated on Table 4.15-1, the populations supported by these two sub-alternatives would also be different. These population impacts are the basis for determining the socioeconomic impacts of the water supply sub-alternatives, as well as many of the environmental impacts described throughout this EIS. There would be no additional population supported by the demand side sub-alternative.

Because the populations supported by the two water supply sub-alternatives would be different, vehicle use under each sub-alternative would also be different. Table 4.15-2 compares vehicle use associated with the *Truckee Meadows Project* and its water supply sub-alternatives.

4.15.3.1 Supply Side Sub-Alternative

The total project cost for the supply side sub-alternative, including the acquisition of water rights, is estimated to be \$51,200,000 (estimate provided by Washoe County). This includes \$29,700,000 for acquisition of surface water rights, \$16,000,000 for facilities to meet drinking water standards, \$1,000,000 for development of four wells, and \$4,500,000 for acquisition of groundwater rights. Financing costs would be additional. No estimate of financing costs is currently available.

By 2015, water from this sub-alternative could support an additional 12,700 people in Lemmon and Spanish Springs Valleys, and an additional 22,700 people in the Truckee Meadows, for a combined total of 35,400 people in the Reno-Sparks metropolitan area (Table 4.15-1). This growth would require about 14,160 new housing units in the metropolitan area (at 2.5 people per unit).

Total VMT in the Truckee Meadows, Lemmon Valley, and Spanish Springs Valley attributed to the supply side sub-alternative in 2015 would be about 778,300 (Table 4.15-2). The population supported by this sub-alternative would contribute to the PM₁₀ emissions

TABLE 4.15-1

COMPARISON OF POPULATION GROWTH SUPPORTED BY THE TRUCKEE MEADOWS PROJECT AND ITS ALTERNATIVES FROM 1995 TO 2015

Area	Truckee Meadows Project	Supply Side Sub-Alternative	Negotiated Settlement Sub-Alternative
Lemmon Valley	2,900 ^(a)	800	2,900
Spanish Springs Valley	43,600 ^(b)	11,900	43,600
Truckee Meadows ^(c)	0	22,700	92,800 ^(d)
Total	46,500	35,400	139,300

^(a) Water supplied to Lemmon Valley by the *Truckee Meadows Project* between 1995 and 2015 represents a part of the growth forecasted to occur by Washoe County for this EIS. An additional 5,400 people are expected to live in Lemmon Valley by 2015; water for these people would be supplied by prior arrangement with Westpac Utilities.

^(b) All forecasted growth in Spanish Springs Valley from 1995 to 2015 (43,600 people) would be supplied water by the *Truckee Meadows Project*. The forecasted growth rate of Spanish Springs Valley was provided by Washoe County for this EIS.

^(c) The "Truckee Meadows" is composed of the following hydrographic basins: Central Truckee Meadows, South Truckee Meadows, Verdi, and Sun Valley.

^(d) Forecasted growth in the Truckee Meadows from 1995 to 2015 is 92,800 people; this estimate was provided by Washoe County for this EIS.

problem in the Truckee Meadows (Section 4.2). Based *solely* on the projected impacts to air quality and increases in traffic, the quality of life for residents in the metropolitan area would decline as a result of this sub-alternative.

Regardless of the measures undertaken to preserve the area's current quality of life, residential growth and development inevitably transform rural/semi-rural areas into more urbanized and suburban settings. Rural and semi-rural suburban settings are highly valued by certain individuals because in this setting they are removed from the pressures of commercial and industrial life. The impersonal, complex pressures of urban life are diminished in rural settings (BLM, 1982). For current residents who value rural settings, the continual urbanization of Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows would detract from their quality of life.

This sub-alternative includes the acquisition of Truckee River irrigation rights. Several people and firms would probably benefit financially from the acquisition and conversion of these rights to municipal and industrial uses.

4.15.3.2 Demand Side Sub-Alternative

The Regional Water Resources Plan estimates the cost of implementing aggressive water conservation measures in new construction at \$11,600,000 (Regional Water Planning and

TABLE 4.15-2

PROJECTED INCREASE IN VEHICLE MILES TRAVELLED (VMT) ATTRIBUTED TO THE TRUCKEE MEADOWS PROJECT AND ITS WATER SUPPLY ALTERNATIVES^(a)

Area	1990	1995	2015		
			Truckee Meadows Project	Supply Side Sub-Alternative	Negotiated Settlement Sub-Alternative
Truckee Meadows	3,818,200	4,700,500	582,700	549,500	2,246,400
Lemmon Valley	387,300	459,400	77,700	21,400	77,700
Spanish Springs Valley	58,540	148,000	760,000	207,400	760,000
Total	4,264,040	5,307,900	1,420,400	778,300	3,084,100

^(a) VMT estimates were provided by the Regional Transportation Commission of Washoe County.

Advisory Board, 1990). Installation of water meters in new construction is estimated to add another \$24,500,000 based on a per meter cost of \$430 for 57,000 houses (estimate provided by Washoe County). Financing costs would be additional. No estimate of financing costs is currently available. The costs for developing a new supply of water associated with these water savings are not included in the analyses of this sub-alternative.

Strict water conservation by future residents in the Reno-Sparks metropolitan area would have some positive socioeconomic impacts. Water conservation could delay construction of new water and wastewater treatment facilities by reducing or delaying the demand for increased water supplies. It would also reduce the use of future water supplies, reduce the cost of operating water systems, and reduce the costs of energy needed to run water systems and heat water because less water would be used.

4.15.3.3 Negotiated Settlement Sub-Alternative

Due to the preliminary nature of the negotiated settlement, no reliable cost estimates are currently available for implementing the settlement.

By 2015, water from this sub-alternative could support an additional 46,500 people in Lemmon and Spanish Springs Valleys, and an additional 92,800 people in the Truckee Meadows, for a combined total of 139,300 people in the Reno-Sparks metropolitan area (Table 4.15-1). This growth would require about 55,720 new housing units in the metropolitan area (at 2.5 people per unit).

The socioeconomic consequences of growth associated with this alternative would be substantial: a large satellite community would be created near the Truckee Meadows over a period of 20 years. Growth in Spanish Springs Valley would cause a substantial increase in demand for housing, schools, health care, and public safety, especially considering that the forecasted growth rate in Spanish Springs Valley would greatly exceed peak historic growth rates in the region. Moreover, large capital-improvement projects would also be required. These impacts, some beneficial and some adverse depending on one's perspective,

would be substantial, but also expected because the land use designations in the master plan for this valley accommodate this growth (Washoe County, 1991a).

Maintaining the area's quality of life is a primary concern of many Washoe County residents. The adoption of "Quality of Life Indicators" is one of twelve major policy initiatives recommended in the Truckee Meadows Regional Plan. Most quality of life concerns expressed during the scoping process for this EIS were related to the impacts of growth on the area's air quality and traffic congestion.

The Truckee Meadows is currently not in attainment with national emission standards for particulate matter (PM₁₀) and carbon monoxide (Sections 3.2 and 4.2). All of Washoe County is currently not in attainment with national standards for ozone. The major sources of these pollutants are motor vehicles and residential wood-burning. The area is soon expected to reach and maintain attainment with carbon monoxide and ozone standards. However, the Truckee Meadows is not expected to reach attainment with PM₁₀ standards by 1994 (Washoe County District Health Department, 1992a). Consequently, the Truckee Meadows will probably be designated as a *serious* nonattainment area for PM₁₀ which will require more stringent methods to control these emissions.

Total VMT in the Truckee Meadows, Lemmon Valley, and Spanish Springs Valley in 2015 under the negotiated settlement sub-alternative would be about 3,084,100 (Table 4.15-2). The population supported by this sub-alternative would contribute to the PM₁₀ emissions problem in the Truckee Meadows (Section 4.2). Based *solely* on the projected impacts to air quality and large increases in traffic, the quality of life for residents in the metropolitan area would decline as a result of this sub-alternative.

Regardless of the measures undertaken to preserve the area's current quality of life, residential growth and development inevitably transform rural/semi-rural areas into more urbanized and suburban settings. Rural and semi-rural suburban settings are highly valued by certain individuals because in this setting they are removed from the pressures of commercial and industrial life. The impersonal, complex pressures of urban life are diminished in rural settings (BLM, 1982). For current residents who value rural settings, the continual urbanization of Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows would detract from their quality of life.

4.16 CUMULATIVE IMPACTS

Cumulative impacts could occur to the environment if water from the *Truckee Meadows Project*, along with water supplies from each of the sub-alternatives analyzed in this EIS, becomes available to the Reno-Sparks metropolitan area. The Council on Environmental Quality (1986) defines a cumulative impact as:

"...the impact on the environment which results from the incremental impact of the action when added to other past, present, and reasonable foreseeable future actions regardless of what agency (federal or non-federal) or person undertakes such other actions. Cumulative impacts can result from individually minor but collectively significant actions taking place over a period of time."

The total water supply theoretically available to the community from these sources amounts to about 70,700 acre-feet, which could support an additional 252,600 people between 1995 and 2032 (Table 4.16-1). Table 4.16-2 shows the estimated acreage of land disturbances in Lemmon Valley, Spanish Springs Valley, and in the Truckee Meadows that could occur to support this cumulative growth.

The following sections describe the cumulative environmental impacts in the Reno-Sparks metropolitan area from development of all these water resources.

TABLE 4.16-1 CUMULATIVE POPULATION GROWTH FROM 1995-2032 SUPPORTED BY THE TRUCKEE MEADOWS PROJECT, THE SUPPLY SIDE SUB-ALTERNATIVE, THE DEMAND SIDE SUB-ALTERNATIVE, AND THE NEGOTIATED SETTLEMENT SUB-ALTERNATIVE ^{(a)(b)}	
Area	Population
Lemmon Valley	9,400
Spanish Springs Valley	77,900
Truckee Meadows	165,300
Total	252,600
^(a) Rounded to the nearest 100. Population projections through 2032 provided by Washoe County. ^(b) The amount of water for each supply is as follows: <i>Truckee Meadows Project</i> 13,000 acre-feet; Supply Side 9,900 acre-feet; Demand Side 8,800 acre-feet; and the Negotiated Settlement 39,000 acre-feet. The total water supply from all these sources would be 70,700 acre-feet. At a use rate of 250 gallons per day per person, this water supply would support approximately 252,600 new people between 1995 and 2032.	

4.16.1 Soils

Population growth supported by the *Truckee Meadows Project* and its alternatives could disturb almost 30,000 acres of soils in the Reno-Sparks metropolitan area for new roads, commercial and residential construction, and related infrastructure. These disturbances would provide a short-term source of air-borne dust during high winds, as well as a ready source of sediment that could adversely affect aquatic life in rivers and creeks in the Truckee Meadows. Wind and water erosion would diminish greatly after disturbed areas are stabilized by vegetation, buildings, and pavement.

Some soils historically used for agriculture in the area, including some prime farmlands, would be permanently taken out of production by urbanization. This could include prime farmlands in Spanish Springs Valleys.

4.16.2 Air Quality

Between 1995 and 2032, an additional 252,600 residents would be supported in the Reno-Sparks metropolitan area. Quantitative estimates of air emissions in the year 2032 for southern Washoe County cannot be made with any degree of certainty. For example, predicting the level of emission controls for motor vehicles or the efficiency of the regional road network could both have wide margins of error. Moreover, improvements in pollution-control technology are likely over the next 40 years which could significantly reduce emissions from motor vehicles. It is also possible that more effective public transportation or completely new modes of transportation would be in use by 2032.

4.16.3 Surface Water

The Truckee River and Pyramid Lake would be the chief surface-waters affected by cumulative growth in the Reno-Sparks metropolitan area. Implementation of the Negotiated Settlement Act, specifically the re-negotiation of reservoir operations on the Truckee River, could have the most lasting positive impacts on both the river and lake. In addition, Washoe County would acquire 1,400 acre-feet of Truckee River water rights that would be transferred to the U.S. Bureau of Indian Affairs

to be held in trust for Pyramid Lake. Because this water would replace poor-quality groundwater that now enters the lake from Honey Lake Valley and the Smoke Creek Desert, the water quality of Pyramid Lake would improve slightly.

On the negative side, conversion of inactive Truckee River irrigation rights to municipal and industrial uses would reduce the flow of the Truckee River because part of this water would be used consumptively and not returned to the Truckee River. Inactive rights are not used for irrigation, but instead flow to downstream water users and to Pyramid Lake. Conversion of active irrigation rights to municipal and industrial uses would tend to increase urban runoff to the Truckee River from sources such as sediment, fertilizers, pesticides, and petroleum products. As these irrigated lands are converted to residential and commercial uses, however, agricultural return flows to the Truckee River, along with their high levels of nitrates and phosphates, would be reduced, thereby benefiting the water quality of the river (EPA, 1984).

Additional sewer capacity would be required in the Truckee Meadows by 2032. The Truckee Meadows Water Reclamation Facility, currently discharging about 29 million gallons per day (mgd) to the Truckee River, would reach its permitted maximum rate of 40 mgd at a community water-use rate of 90,000 acre-ft/yr (current water use is about 65,000 acre-ft/yr). As the population grows, the treatment facility could be expanded or other land-disposal facilities could be constructed; the method for disposing of wastewater in 2032 is not currently known. Nevertheless, discharges to the river up to the 40 mgd level would cause both beneficial and adverse impacts to the river (EPA, 1984).

4.16.4 Groundwater

Although no specific proposals exist for wastewater disposal this far in the future, land-based disposal of treated wastewater in the Truckee Meadows, Lemmon Valley, and Spanish Springs Valley could help recharge each valley's depleting aquifers. If a wastewater

TABLE 4.16-2	
CUMULATIVE LAND DISTURBANCES FROM 1995-2032	
Area	Total Acreage
Lemmon Valley ^(a)	800
Spanish Springs Valley ^(b)	15,600
Truckee Meadows ^(b)	13,200
Total	29,600
^(a) Assumes an average of five dwelling units per acre, plus 25 percent for streets and other types of land uses (commercial, industrial, etc.).	
^(b) Assumes an overall gross density of two dwelling units per acre; includes all land use types (commercial, industrial, etc.), plus 15 percent for streets.	

treatment plant is constructed in the southern end of Spanish Springs Valley, infiltration could increase groundwater flows from Spanish Springs Valley to the Truckee Meadows. Data are not available to quantify this potential impact. The U.S. Geological Survey is currently investigating groundwater conditions in the valley. The quality of the discharged water would not be allowed to degrade the quality of the receiving groundwater because discharges would be subject to Nevada State regulations.

4.16.5 Wetlands

Federal law, as well as the Truckee Meadows Regional Plan (Truckee Meadows Regional Planning Agency, 1991), establish policies for protecting and retaining wetlands. These include wetlands that would be regulated under Section 404 of the Clean Water Act, stream environments, playas, spring-fed stands of riparian vegetation, and non-404 wetlands. Nevertheless, the addition of a quarter million people between 1995 and 2035 would likely result in the conversion of some agricultural lands and wetlands to residential and commercial uses. This would be especially true in Spanish Springs Valley where wetlands associated with water leakage from the unlined Orr Ditch could dry up as Orr Ditch agricultural water rights are converted to municipal and industrial uses. Part of the large supply of treated wastewater generated by the community would be available for wetlands enhancement or wetland development in Lemmon Valley, Spanish Springs Valley, and in the Truckee Meadows.

Section 206 of the Negotiated Settlement Act authorizes and directs the Secretary of the Interior to acquire water rights to sustain 25,000 acres of wetlands in Lahontan Valley east of Fallon, Nevada. The U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation are currently preparing an EIS on the negotiated settlement to be released in the mid-1990s.

4.16.6 Vegetation

Cumulative impacts to vegetation would occur from the removal of vegetation over almost 30,000 acres of land in the Reno-Sparks metropolitan area for residential and commercial development. The majority of this development would affect salt desert shrub and sagebrush communities. Continued development in the western Truckee Meadows would impact sagebrush/juniper communities in the foothills of the Sierra Nevada. Development in the southwest Truckee Meadows would reduce areas of wet meadows. New residential developments within and near the fringes of the metropolitan area could stress xeriscaping.

The continued conversion of Truckee River irrigation rights to municipal and industrial uses would reduce the acreage of irrigated pasture and hay lands in the area. Reductions in irrigation would also reduce the acreage of wet meadow/wetland habitat, particularly in the southwest Truckee Meadows and in Spanish Springs Valley where this habitat is maintained by seepage from irrigation ditches. These land conversions, however, must comply with federal wetland regulations, as well as regional and local wetlands policies.

Groundwater pumping could lower the water table in localized areas of the Truckee Meadows, thereby affecting vegetation that is maintained by near-surface groundwater.

Impacts to these areas, especially to wetlands, can not be assessed because the locations of wells to be pumped are not known.

4.16.7 Wildlife

Cumulative impacts to wildlife and wildlife habitat are related directly to the loss of native vegetation and habitat along the fringes of the expanding metropolitan area.

Section 207 of the Negotiated Settlement Act authorizes and directs the Secretary of the Interior to acquire water rights and develop plans for the conservation and recovery of the cui-ui and Lahontan cutthroat trout. The U.S. Fish and Wildlife Service and the U.S. Bureau of Reclamation are currently preparing an EIS on the operation of Truckee River reservoirs for release in the mid-1990s. Also, the acquisition by Washoe County of 1,400 acre-ft/yr of Truckee River water for dedication to Pyramid Lake could have beneficial impacts to both species.

Population growth in Lemmon Valley, Spanish Springs Valley, and the Truckee Meadows by 2032 would require about 30,000 acres for residential and commercial purposes. This development would permanently remove habitat for a variety of small mammals and birds, mourning dove and chukar, mule deer, pronghorn antelope, and several candidate species for listing under the Endangered Species Act. Residential and commercial development near Peavine Mountain, along the foothills of the Carson Range, and west of Mount Rose would adversely affect important winter habitat for the Loyalton-Truckee interstate mule deer herd.

The addition of a quarter million people to the Reno-Sparks metropolitan area between 1995 and 2035 would increase recreational and hunting use of nearby undeveloped lands. This could increase hunting pressure on local game populations and increase harassment and disturbance of wildlife.

4.16.8 Wild Horses

Wild horse *Herd Management Areas* would not be directly affected by population growth in the Reno-Sparks metropolitan area. As the area continues to grow, however, more frequent conflicts are likely to occur between suburban land owners and wild horses. As access to public land improves and demands for dispersed outdoor recreation increase, additional stress on wild horse populations would likely occur through harassment, noise, contact with humans, and loss of habitat.

4.16.9 Visual Resources

The addition of a quarter million people between 1995 and 2035 would contribute to the further urbanization of the Reno-Sparks metropolitan area. This urbanization would disturb almost 30,000 acres of land for new roads, commercial and residential developments, and related infrastructure. Visual changes would be most evident where currently rural landscapes are transformed into more urban landscapes. Water conservation, especially the

use of xeriscaping in the Reno-Sparks metropolitan area, would introduce a new visual character to growing neighborhoods. Visual contrasts would decrease between native and residential vegetation along the fringes of the growing metropolitan area.

4.16.10 Cultural Resources

Population growth through 2032 would contribute to the further urbanization of the Reno-Sparks metropolitan area. Direct impacts to cultural resources could occur from land disturbances associated with construction on some 30,000 acres. In addition, cultural resources on nearby public lands could be degraded or destroyed due to increased vandalism associated with a population center of approximately 500,000 people.

4.16.11 Recreation

A large increase in population would require many additional recreational facilities to be constructed throughout the Reno-Sparks metropolitan area. The demand for dispersed outdoor recreation would also increase, possibly causing increased vandalism and degradation of public lands.

4.16.12 Livestock Grazing

As the Reno-Sparks metropolitan area expands, additional rangeland and irrigated pasture would be converted to residential and commercial developments. Recreational use of nearby public lands could cause increased conflicts with livestock operators and their livestock. Grazing would continue to decline with increasing urbanization of lands adjacent to the metropolitan area.

4.16.13 Minerals

No cumulative impacts would occur to mineral resources as a result of growth from the *Truckee Meadows Project* and its alternatives.

4.16.14 Land Use

The estimated 252,600 people that would be added to the Reno-Sparks metropolitan area between 1995 and 2032 would require roughly 30,000 acres for new roads, commercial and residential developments, and related infrastructure. Open space surrounding the Truckee Meadows would continue to diminish. Demands would increase for recreational use of nearby public lands, but access to these lands could be impeded by private development along the fringes of the metropolitan area.

4.16.15 Socioeconomics

The socioeconomic consequences of almost doubling the population of the Reno-Sparks metropolitan area from 1995 to 2032 would include the continued development of a large satellite community in Spanish Springs Valley, as well as a substantial increase in the population of the Truckee Meadows. This relatively large metropolitan area would require, among other things, housing, schools, health care, and public safety.

Continued growth would affect the area's quality of life. To some residents, the quality of life would deteriorate due to increased traffic congestion and air pollution. To others, however, the area's quality of life would improve because of additional cultural amenities, restaurants, and job opportunities.

4.17 POSSIBLE MITIGATION

This section describes mitigation measures which could be implemented to avoid or reduce the projected impacts of the proposed action or its alternatives. These measures will be considered for possible inclusion as right-of-way grant stipulations in the Record of Decision. The BLM has the authority to implement those measures that apply to public lands. The mitigation measures contained here are in addition to Washoe County's proposed measures to minimize impacts described in Section 2.1.5, and the BLM's standard operating procedures to protect public lands described in Section 2.1.6.

4.17.1 Rights-of-Way

- *Exclude livestock and off-road vehicle use along the rights-of-way during re-vegetation.*

Several methods exist to exclude and/or minimize livestock and off-road vehicles from the rights-of-way to protect newly-established vegetation. Fencing the rights-of-way is generally not considered cost effective. The cost of fencing a linear right-of-way can rarely be justified on the basis of the improved revegetation that could occur. For that reason, fencing has not been required for any major pipeline right-of-way in Nevada. Revegetation is likely to occur regardless of this measure, but would be improved if it was implemented.

- *Erect signs or construct berms to protect springs and other sensitive areas from vandalism and pollution.*

This technique is feasible and could have a beneficial impact to springs and other sensitive areas. This measure, however, could also result in *increased* vandalism and water pollution by bringing attention to certain areas. If properly implemented in the appropriate places, this measure would likely mitigate some adverse impacts.

4.17.2 Wetlands

- *Impacts to all affected wetlands should be mitigated by either (1) using water from active wells and surface water rights; and/or (2) restoring or creating wetlands outside*

the affected hydrologic basins at a ratio of 1.5-2.0 acres gained for each acre lost; and/or (3) restoring to their original condition springs that were developed in the past in Honey Lake Valley.

1. Wetlands in the affected hydrologic basins could likely be maintained through construction of wells at each affected wetland. In Honey Lake Valley, this could reduce the amount of water available for export. In the Smoke Creek Desert, additional wells could reduce groundwater flows to Pyramid Lake. This impact, in turn, could be mitigated by acquisition of additional Truckee River irrigation rights and their dedication to Pyramid Lake.
2. The restoration or creation of wetlands outside the affected hydrologic basin is feasible with the use of treated wastewater in Lemmon and Spanish Springs Valleys. This wastewater could benefit the wetlands associated with the Orr Ditch in southern Spanish Springs Valley, especially as Orr Ditch water rights are converted to municipal and industrial uses.
3. The restoration of springs to create wetlands in Honey Lake Valley does not appear feasible. Springs in the valley that have stopped flowing have done so because of groundwater pumping for irrigation. This pumping has lowered the groundwater table sufficiently in some areas to terminate spring flow. Because the proposed action would further lower the groundwater table at these springs, their restoration does not appear feasible.

4.17.3 *Vegetation in Water Source Area*

- *If impacts to the black greasewood community are detected through monitoring, the amount and rate of groundwater pumping at Fish Springs Ranch should be reduced.*

The measure does not appear feasible. In order to ensure that no impacts to the black greasewood community would occur, it is likely that all export of water from Honey Lake Valley be eliminated. This would adversely affect future customers in Lemmon and Spanish Springs Valleys and result in a significant loss of investment by Washoe County. However, in the long term this measure could help maintain black greasewood populations in Honey Lake Valley.

- *Previously disturbed lands in Honey Lake Valley could be revegetated using native plant species as off-site mitigation of impacts to greasewood populations*

Data are not sufficient to determine the effects of this measure. No attempts to revegetate disturbed lands with greasewood have occurred in this area. Revegetation with other native species, such as antelope bitterbrush, have met with very little success.

4.17.4 *Pyramid Lake Reservation*

- *If impacts to the Pyramid Lake Reservation are detected through monitoring, the amount and rate of groundwater pumping at Fish Springs Ranch should be reduced.*

The groundwater model used in the EIS should be run to establish a threshold pumping rate that would have no effect to resources on the Pyramid Lake Reservation.

The groundwater model used in the EIS was run at reduced pumping rates to determine if a threshold exists that would avoid projected impacts to the Reservation, including impacts to wetlands in the southwestern Smoke Creek Desert. The results indicate that *any* groundwater pumping in excess of the current pumping levels at Fish Springs Ranch could reduce the flow of groundwater to wetlands in the southwestern Smoke Creek Desert and reduce the flow of groundwater to Pyramid Lake. Impacts to the Reservation would be less if the pumping rate at Fish Springs Ranch was less than planned.

- *The applicant could be requested to provide funds to the Pyramid Lake Paiute Tribe to compensate for the increased pumping costs that could result from lowering of the water table in the southern Smoke Creek Desert.*

This measure would compensate for future cost increases for pumping associated with the Tribe's projected use of its potential reserved water rights for irrigation farming. However, this measure would not affect the reduction in the water table on the Reservation portion of the southern Smoke Creek Desert.

- *Monitoring wells should be established in the Terraced Hills to identify water movement between the Smoke Creek Desert and Pyramid Lake Basin.*

Although monitoring by itself is not mitigation, monitoring wells can provide information to help mitigate impacts before they become significant. The U.S. Geological Survey is currently monitoring three wells in this area.

4.17.5 Private Property Owners

- *Washoe County should fully compensate private property owners for impacts to the quality and the quantity of well water, and repair any damages to structures caused by subsidence.*

Private property owners would be fully compensated for all losses, including losses from subsidence, pursuant to Chapter 37 of the Nevada Revised Statutes.

4.17.6 Sierra Army Depot

- *Additional monitoring wells should be installed along the California/Nevada border (2 wells), the eastern boundary of the Sierra Army Depot (2 wells), and areas to the west and north of the Depot's potable supply wells (3 wells). Add the Sierra Army Depot to Washoe County's proposed monitoring committee.*

Although monitoring by itself is not mitigation, additional monitoring wells could provide information to help mitigate impacts before they become significant. The additional monitoring would provide more information concerning the movement of groundwater near the Depot, but at additional cost to Washoe County. Adding the Sierra Army Depot to the

monitoring committee would help to ensure that the Depot's concerns are adequately addressed by the committee.

4.18 UNAVOIDABLE ADVERSE IMPACTS

Granting the rights-of-way would result in some direct and indirect adverse impacts that could not be avoided or mitigated. Native vegetation along the rights-of-way would be removed for construction of the pipelines. The short-term adverse effects to wildlife, air quality, and visual resources from the removal of this vegetation would be reduced gradually through the years as new vegetation becomes established. Despite these efforts, many parts of the right-of-way would retain a visual character that is distinct from the surrounding native vegetation.

The most prominent of the unavoidable impacts in the water source area are associated with drawdown of the groundwater table in Honey Lake Valley and in parts of neighboring valleys. This drawdown could gradually reduce the density of phreatophytic plants over a large part of Honey Lake Valley, with little or no opportunity to mitigate the potential impact. Wildlife that is dependent on this vegetation could be adversely affected. If the density of greasewood vegetation decreases, the area could become more susceptible to wind erosion. This potential increase in dust emissions would not be expected to seriously degrade air quality in the valley because annuals and other types of vegetation would be expected to colonize areas formerly inhabited by greasewood.

Lowering the water table could also gradually reduce the rate of discharge at low-elevation springs and wetlands in parts of eastern Honey Lake Valley and in the southwestern part of the Smoke Creek Desert. These impacts could be reduced by supplementing affected spring flow and wetlands with other sources of water such as agricultural water and groundwater, but these mitigation measures can produce their own impacts, thereby further exacerbating the problem.

Some land subsidence and fissuring of the land surface would also be unavoidable as the water table is lowered throughout eastern Honey Lake Valley.

The potential for future commercial development in eastern Honey Lake Valley would be permanently reduced because the entire safe water yield of the basin would be exported.

Water from the *Truckee Meadows Project* would accommodate growth in Lemmon and Spanish Springs Valleys from 1995 to 2015. This growth would lead to unavoidable changes to the existing environment and to the socioeconomic setting of these valleys, as well as to other parts of the Reno-Sparks metropolitan area. This growth would cause some unavoidable adverse impacts to the community, including increased traffic congestion and air pollution. Moreover, the quality of life for some residents would decline as the community grows. Policies now in place within the community, as described in the *Truckee Meadows Regional Plan* (Truckee Meadows Regional Planning Agency, 1991), are designed to address the adverse impacts of population growth.

4.19 *SHORT-TERM USE OF THE ENVIRONMENT VERSUS LONG-TERM PRODUCTIVITY*

This section describes the balance between the short-term use of the land versus the long-term productivity of the land without the project. Short-term is considered to be the life of the project, here defined as 100 years. Long-term is beyond 100 years.

The pipeline routes are currently used for grazing, recreation, and wildlife. Construction of the pipelines and their operation over the next 100 years would be expected to have little impact on these land uses. The long-term productivity of these areas would not be expected to suffer because of the pipelines and associated facilities.

The short- and long-term productivity of eastern Honey Lake Valley and parts of neighboring basins would be reduced at the expense of growth in Lemmon and Spanish Springs Valleys. In his decision to grant Washoe County the inter-basin water transfer, the State Engineer concluded that such a transfer would be in the public interest.

4.20 *IRREVERSIBLE AND IRRETRIEVABLE COMMITMENT OF RESOURCES*

An irretrievable commitment of resources results when actions change an area to the point that it cannot be restored to its original undisturbed condition. In addition, a commitment of resources that completely consumes or removes a non-renewable resource is considered to be irretrievable.

Approximately 80 acres of public land would be irreversibly committed for an access road to the pipelines, the water storage tanks, and associated facilities. The steel, sand and gravel, and other materials for the pipelines, the facilities in Honey Lake Valley and in the delivery area, and the fuel and disinfectant, represent irretrievable commitments of resources.

The visual character of the rights-of-way would remain distinct from the surrounding native vegetation and, as such, can be considered to be irreversible.

Long-term pumping of groundwater in Honey Lake Valley represents an irreversible commitment of resources. The storage capacity of the aquifer would be reduced permanently. Vegetation in Honey Lake Valley could be irreversibly altered. Even if the amount and rate of groundwater pumping were reduced or terminated, there is no guarantee that the water table would rise fast enough to mitigate the stress to these plant communities, although it is possible that some plant communities would respond.

The physical, biological, and social environments of Lemmon and Spanish Springs Valleys would be irreversibly altered by population growth associated with the *Truckee Meadows Project*.

5.0 CONSULTATION AND COORDINATION

The BLM has ensured a comprehensive approach to this EIS by seeking out and inviting the participation of other federal agencies and Indian tribes as cooperating agencies. The BLM signed agreements with the U.S. Environmental Protection Agency, the U.S. Bureau of Indian Affairs, the U.S. Fish and Wildlife Service, the U.S. Army, the U.S. Geological Survey, and the Pyramid Lake Paiute Tribe. Each of the agencies has jurisdiction by law or special expertise for particular sections of this document. The participation of the BLM and its cooperating agencies in the preparation of this EIS does not imply endorsement of the proposed action. Specific Memoranda of Agreement (MOU) were as follows:

U.S. Environmental Protection Agency: Responsible for the air and water quality sections of the EIS. The MOU does not abridge the independent review of the EIS which EPA conducts pursuant to Section 309 of the Clean Air Act and the National Environmental Policy Act.

U.S. Bureau of Indian Affairs: Responsible for providing review and comments regarding potential impacts of the proposed action on Indian lands.

U.S. Army: Responsible for guiding the preparation of the analyses of impacts to the Sierra Army Depot.

U.S. Geological Survey: Responsible for technical review and comments on interim work products associated with groundwater analyses and impacts in Honey Lake Valley and adjacent basins.

U.S. Fish and Wildlife Service: Responsible for consultations under the Endangered Species Act, advice on wetlands analyses, and technical assistance for the analysis of impacts to migratory birds.

Pyramid Lake Paiute Tribe: Responsible for providing review and comments regarding potential impacts of the proposed action on Tribal operations and the Reservation.

The BLM invited cooperator comments throughout the preparation of the Draft EIS, conducted interagency meetings, met with individual cooperators and provided formal review and comment periods on early drafts of chapters 1 and 2 and on a full Preliminary Draft EIS. The cooperators comments and environmental analyses were used to the maximum extent feasible, consistent with BLM's role as the lead agency. In addition, consultations with the U.S. Fish and Wildlife Service pursuant to Section 7 of the Endangered Species Act were also conducted with regard to potential adverse impacts to threatened and endangered fish in Pyramid Lake.

Scoping for this EIS has been an open public process. The BLM has encouraged public comment throughout the preparation of the EIS. The history of this process is described briefly in the following paragraphs.

On June 18, 1990, the BLM issued a Notice of Intent to prepare an environmental document on the proposed rights-of-way. Comments on the scope of the document were due at the BLM's Carson City Office by July 23, 1990. The BLM received a total of 149 letters. Based on these letters, the BLM decided that an EIS should be prepared.

On July 24, 1990, the BLM issued a Notice of Intent in the Federal Register and in local newspapers throughout the affected region that an EIS would be prepared. All comments on the scope of the EIS were due at the BLM's Carson City Office by August 23, 1990. Twenty-five letters were received. In addition to these letters, 20 letters were sent directly to the Nevada State Engineer and to the Washoe County Commissioners from landowners in Honey Lake Valley. Since that time, the BLM has received a dozen or so additional scoping letters from the public and from several federal agencies.

All letters received by the BLM, the Nevada State Engineer, and the Washoe County Commissioners were part of the scoping process for the EIS. Scoping issues were also identified from (1) records of public meetings in Reno by the *Citizen's Advisory Board to the Truckee Meadows Project* held between February 1989 and October 1990; (2) records and subsequent correspondence of a public hearing held in Reno on July 6, 1989, before the Washoe County Board of Adjustment concerning the proposed issuance of a Special Use Permit to Washoe County for construction of the *Truckee Meadows Project* [the Special Use Permit was issued July 25, 1989, by the Washoe County Commission]; (3) records of hearings in Sacramento, California, on October 25, 1989, by the *Senate Select Committee on the Sierra/Cascade/Klamath Watersheds* on the use and export of water from interstate groundwater basins in northeast California; and (4) transcripts of the September 14, 1990, *Public Comment Session* of the Nevada State Engineer's hearings in Sparks on Washoe County's applications to transfer groundwater from Honey Lake Valley.

Table 5-1 summarizes the issues raised during public scoping. The issues are arranged by geographic area, as follows: the *water source area*, the *delivery/use area*, and the intervening *pipeline routes* (these geographic areas are identified on Figure 3-1). A fourth group, labelled *other issues*, is unrelated to geography. Based on the concerns raised during scoping, issues and alternatives to be examined in the EIS were identified.

In August 1991, and again in February 1992, newsletters were mailed to all interested and affected parties. Both newsletters emphasized that scoping is an on-going process and that the BLM encourages and welcomes comments throughout the EIS process. The first newsletter described the proposed rights-of-way, the issues to be examined in the EIS, and a tentative schedule for release of the Draft EIS to the public. It also identified the people responsible for preparing the EIS and described the role of each cooperating agency. The second newsletter described the status of the EIS, changes in the schedule, and alternative routes for the pipelines.

TABLE 5-1

ISSUES RAISED DURING PUBLIC SCOPING

<i>Geographic Area and Major Concern</i>	<i>Issues (number in parenthesis refers to the number of times the issue was raised by the public)^(a)</i>
<i>Water Source Area (Honey Lake Valley and Neighboring Areas)</i> Drawdown of the water table, and its effects on:	Vegetation (especially riparian and phreatophytic vegetation) (137) Spring discharge, wetlands, Susan River, Honey Lake, Pyramid Lake (98) Wildlife (77) Other groundwater users and land owners (32) Subsurface flow of groundwater to Pyramid Lake and Smoke Creek Basins (23) Air quality (from potential reductions of vegetative cover) (17) Continued availability of groundwater for the geothermal plant near Wendel, California (8) BLM Wilderness Study Areas, wildlife management areas, and other opportunities for recreation (8) Long-term availability of the water to be diverted (5) Grazing (5) Growth/quality of life in the Susanville area (<5)
Effects on water quality, including:	Degradation of water quality due to heavy pumping (34) Migration of contaminants at the Sierra Army Depot (15) Degradation of water quality at the geothermal plant near Wendel, CA (5)
<i>Delivery/Use Area (Lemmon and Spanish Springs Valleys and the Truckee Meadows)</i> Growth in the Truckee Meadows Region and its effects on:	Air quality (27) The quality of life in the Truckee Meadows (20) Other resources in the area (wildlife, archaeological sites, etc.) (13) Groundwater/septic systems in the North Valleys (2)
Discharge to the Truckee River and its effects on:	Wildlife, especially threatened, endangered, and candidate species (37)

TABLE 5-1 (Continued)

ISSUES RAISED DURING PUBLIC SCOPING

<i>Geographic Area and Major Concern</i>	Issues (number in parenthesis refers to the number of times the issue was raised by the public) ^(a)
<i>Pipeline Routes</i>	Effects on wildlife and wild horses (11) Effects on cultural resources (11) Alternative pipeline routes (10) Effects on visual resources (3) Effects on historic trails (1) Induced growth along U.S. Highway 395 (1)
<i>Other Issues</i>	Alternatives, especially conservation (75) Cumulative effects with other pumping in the affected area, and (2) the precedent for constructing additional pipelines to the Truckee Meadows from farther north in Washoe County (63) Consistency with existing land-use plans, local planning, and other existing and pending legislation (35) Costs of the project and who pays (26) BLM should not get involved with issues related to local growth (10) Need to monitor aquifer drawdown and develop procedures to safeguard natural resources during project construction (2) Liability if the pumping rate is not sustainable (1)
^(a) This number represents the number of comments received on that issue. Note that a single scoping letter usually identified many issues; hence, the total number of comments far exceeded the total number of letters which numbered approximately 200.	

The following agencies, counties, and groups were contacted in the course of compiling this EIS.

• *FEDERAL*

U.S. Environmental Protection Agency
U.S. Fish and Wildlife Service
U.S. Department of the Army
U.S. Bureau of Indian Affairs
U.S. Geological Survey
U.S. Bureau of Reclamation
U.S. Soil Conservation Service
U.S. District Court WaterMaster for the
Truckee and Carson Rivers
U.S. Army Corps of Engineers

• *NEVADA STATE*

Nevada State Engineer
Nevada Division of Environmental
Protection
Nevada Department of Wildlife
Nevada Natural Heritage Program
Nevada State Historic Preservation
Office
Nevada Department of Conservation
and Natural Resources

• *CALIFORNIA STATE*

California Department of Fish and
Game
California Department of Water
Resources

• *COUNTY*

Washoe County Air Quality
Management Division
Washoe County Department of
Comprehensive Planning
Washoe County Department of Public
Works
Regional Transportation Commission

Washoe County Department of
Development Review
Washoe County Health Department
Washoe County Utility Division
Inyo County, California
Lassen County, California

• *LOCAL AGENCIES &
GOVERNMENTS*

City of Reno, Nevada
City of Sparks, Nevada
Truckee Meadows Regional Planning
Agency
Truckee Meadows Regional
Transportation Commission

• *NATIVE AMERICANS*

Pyramid Lake Paiute Tribe
Reno-Sparks Indian Colony

• *OTHER CONTACTS*

Desert Research Institute
Nature Conservancy
Point Reyes Bird Observatory
Plumas Geo-Hydrology
Stetson Engineers, Inc.
JBR Consultants Group
CH2M Hill
Kennedy/Jenks Consulting Engineering
WEN, Inc.
Westpac Utilities

6.0 LIST OF PREPARERS

This EIS was prepared by Science Applications International Corporation (SAIC). SAIC retained the services of WESTEC, Broadbent and Associates, Inc., and Mariah Associates, Inc. The EIS was prepared under the supervision of the U.S. Bureau of Land Management. Cooperating agencies for the EIS were the U.S. Fish and Wildlife Service, U.S. Environmental Protection Agency, Sierra Army Depot, U.S. Bureau of Indian Affairs, Pyramid Lake Tribe and the U.S. Geological Survey. Tables 6-1, 6-2 and 6-3 list the names and qualifications of the people primarily responsible for preparation and review of the EIS and supporting documents.

TABLE 6-1

EIS PREPARERS

Staff	Credentials	Yrs Exp.	Responsibility
Ed Oakes (SAIC)	M.S. Geology	19	EIS Manager
Gary Bertolin (SAIC)	PhD. Meteorology	15	Air Quality
Catherine Clarke (WESTEC)	B.A. Geography	5	Visual & Recreation
Bob Broadbent (Broadbent and Assoc.)	M.S. Hydrology	12	Surface Water
Scott Imus (SAIC)	M.S. Forestry	16	Soils, Grazing, Wild Horses & Surface Water
Bob Kautz (Mariah Assoc.)	PhD. Archeology	23	Cultural Resources
Rex Massey (SAIC)	M.B.A Business	6	Land Use & Socioeconomics
Kathy Oakes (WESTEC)	M.S. Ecology	19	Vegetation & Wildlife
Carol Oberholtzer (WESTEC)	M.S. Hydrology	12	Groundwater
Carter Schleicher (WESTEC)	B.S. Wildlife	17	Wetlands

TABLE 6-2

**LEAD AGENCY REVIEW TEAM
U.S. DEPARTMENT OF THE INTERIOR, BUREAU OF LAND MANAGEMENT**

Staff	Credentials	Yrs Exp.	Responsibility
Mike Phillips	B.S. Range/Forest Mgmt.	25	Area Manager
David Loomis	M.S. Land Use Planning	15	Project Manager
Jim DeLaureal	B.S. Agronomy	13	Soils
Bashir Sulahria	PhD. Hydrology	24	Air & Water
Jim Ramakka	M.S. Wildlife Ecology	21	Wildlife
Cub Wolfe	B.S. Range/Wildlife Mgmt.	16	Vegetation & Range
John Axtell	M.S. Wildlife Mgmt.	5	Wild Horses
Prill Mecham	B.A. Anthropology	14	Cultural Resources
Terry Knight	B.S. Political Science	13	Visual & Recreation
Chuck Pope	B.S. Range Mgmt.	17	Land Use

TABLE 6-3

COOPERATING AGENCY REVIEWERS

Staff	Cooperating Agency	Credentials	Yrs Exp.	Responsibility
Jeanne Geselbracht	U.S. Environmental Protection Agency	M.A. Physical Geography	6	Air, NEPA, Water, and Wetlands
Stephanie Valentine	U.S. Environmental Protection Agency	M.S. Wildland Resource Science	8	Air Quality
Cheryl McGovern	U.S. Environmental Protection Agency	B.A. Environmental Studies and Planning	8	Surface Water and Wetlands
Carol Boughton	U.S. Geological Survey	M.S. Hydrology/Hydrogeology	15	Groundwater
Doug Maurer	U.S. Geological Survey	B.S. Geology	14	Groundwater
Dan Culver	Sierra Army Depot	Depot Legal Council	7	Depot Issues
Tracy Totten	Sierra Army Depot	B.S. Agricultural Engineering	7	Depot Issues
Chester Buchanan	U.S. Fish & Wildlife Service	M.S. Zoology	23	Wildlife & Wetlands
Mary Jo Elpers	U.S. Fish & Wildlife Service	M.S. Physiology	15	Wildlife & Wetlands
Robert Pelcyger	Pyramid Lake Tribe	LLB	25	Tribal Issues
Ali Sharoody	Pyramid Lake Tribe	M.S. Civil Engineering	12	Tribal Issues
Mervin Wright	Pyramid Lake Tribe	B.S. Agriculture	2	Tribal Issues
Tom Strekal	U.S. Bureau of Indian Affairs	M.S. Aquatic Biology	20	Tribal Issues
Lew Fry	U.S. Bureau of Indian Affairs	M.S. Civil Engineering	22	Tribal Issues

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GLOSSARY

Acre-foot	Unit of measure equal to the volume of water in a one-acre-area that is one foot deep; equal to 325,900 gallons of water.
Alkaline	Having a pH greater than 7. Also referred to as being basic (see also pH). Characteristic of soils and waters in arid regions.
Allotment	An area designated for the use and management of a prescribed number and kind of livestock.
Allotment Management Plan (AMP)	A documented program that applies to livestock operations on public lands and is prepared in consultation with the permittee(s) or lessee(s) involved.
Alluvial fan	A fan-shaped deposit of generally coarse materials created where a stream flows out onto a gentle plain.
Alluvium	Clay, silt, sand, gravel, or similar material deposited by running water.
Ambient air	Surrounding air. Generally referred to as a concentration of a particular air pollutant within the surrounding air (ambient concentration).
Animal Unit Month (AUM)	The amount of forage necessary for the sustenance of one cow and calf or its equivalent for one month. Equal to five sheep or five deer.
Anion	A negatively charged ion.
Aquifer	A rock unit or group of rock units, that contain sufficient saturated permeable material to yield significant quantities of water to wells and springs.
Area of Critical Environmental Concern (ACEC)	An area on public lands where special management attention is required to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources, or other natural systems or processes, or to protect people from natural hazards.
Artesian	Said of groundwater under hydrostatic pressure. The water level in an artesian well rises above the top of the artesian aquifer which it taps.
Artifact	Any object of some antiquity made by humans.
Atlatl	Man-made object used for throwing darts. The atlatl was held in the hand and attached to the end of the dart. The atlatl functioned to effectively lengthen the throwing arm to achieve greater force.

Attainment area	An air-quality term applied to an area where concentrations of six criteria pollutants (particulates, sulfur dioxide, nitrogen oxides, carbon monoxide, ozone and lead) are at or below the National Ambient Air Quality Standards (NAAQS). Non-attainment conditions exist where concentrations of one or more of these pollutants exceed these standards.
Backfill	The placement of geologic/soils materials, originally removed or new, into the excavated areas of a trench.
Base metal	Any of the more common and more chemically active metals, e.g., lead, copper.
Basin and Range	A region of north-trending mountain ranges and valleys and encompassing western Utah, Nevada, western and southern Arizona, and southeastern California.
Basin fill	Unconsolidated material such as sand, gravel, and silt eroded from surrounding mountains and deposited in a valley.
Bedrock	The solid rock that underlies soils and other unconsolidated (loose) material beneath the earth's surface.
Biota	The flora and fauna of a region.
Browse	To feed on leaves and young shoots of woody vegetation, such as shrubs and young trees, as opposed to feeding on grasses (to graze). Browse is used in reference to the diets of big game animals and livestock.
Candidate species	Species designated by the U.S. Fish and Wildlife Service as candidates for potential future listing as Endangered or Threatened pursuant to the Endangered Species Act.
Capillary action	The movement of water through small pore spaces in soil as a result of the attraction of the liquid to the solid surfaces of the soil particles.
Capillary fringe	The zone of soil or unconsolidated material above the saturated zone (or groundwater table) into which moisture rises by capillary action.
Carrying capacity	The maximum number of individuals, animals, or livestock that the environment can support without detrimental effects.
Cation	A positively charged ion.

Chukar	<i>Alectoris graeca</i> --a type of European partridge that has been successfully introduced onto western rangelands and has become a popular upland game bird.
Computer model	In this EIS, a system of postulates, data, and inferences presented as a mathematical description of a natural system.
Cone-of-depression	The shape of the water table that results from drawdown at a well; the hydraulic gradient is toward the well.
Coordinated Resource Management and Planning	A planning process used by the Bureau of Land Management that includes public users, interest groups, agencies and affected individuals in the decision-making process before on-the-ground implementation of an activity plan.
Cultural resources	Any of various non-renewable artifacts or other antiquities that have been made or utilized by past human cultures. By extension, sensitive areas, which exhibit past human habitation or activities, as well as any contained features or structures.
Cumulative impact	The environmental impacts of a proposed action in combination with the impacts of other past, existing and proposed actions.
Deciduous	Refers to broad-leaved plants that seasonally shed their leaves (usually in winter, but sometimes in response to drought).
Discharge (hydrologic)	With reference to groundwater, the process by which groundwater leaves the zone of saturation via evaporation, evapotranspiration, or by flow to the surface through springs and seeps.
Desiccation cracks	Surface fractures that can result from the drying of soil or porous sedimentary rock.
Dry wash	A defined drainage channel in arid regions that is dry except following a major storm or heavy spring snowmelt.
Drawdown (of water table)	Lowering of the elevation of the groundwater table, usually from pumping wells, but can occur naturally during periods of prolonged drought.
Early seral condition	Synonymous with poor ecological conditions.
Ecosystem	A biologic system, composed of organisms, their interrelationships, and their environment.

Effluent	Waste material (smoke, liquid, or sewage) discharged to the environment.
Emergent (vegetation)	Erect plants that are generally rooted in standing water but whose stems emerge above the water. These plants do not tolerate flooding of the entire stem or plant. Familiar examples are cattails and bulrushes.
Endangered species	Plants and animals designated by the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act of 1973. An endangered species is "any species which is in danger of extinction through all or a significant portion of its range."
Endemic	Restricted or peculiar to a locality or region.
Environmental Impact Statement	A document prepared pursuant to the National Environmental Policy Act (NEPA) for use by decision makers and the public in which impacts of proposed actions are analyzed.
Equilibrium conditions	The condition of a system in which the result of all acting forces is zero. Used here in reference to a groundwater system in which all inputs (of water) equal the outputs. The groundwater table is neither rising nor falling under equilibrium conditions.
Evapotranspiration	The combined loss of water from an area, by evaporation from the soil surface and by transpiration from plants.
Extinction depth	The minimum depth from the surface to the groundwater table at which plant species that rely on groundwater can no longer survive.
Facultative phreatophyte	Plants that utilize moisture from groundwater for a portion or their water requirements.
Fault	A fracture in rock along which movement can be demonstrated.
Feral	Having returned to a wild or untamed state from domestication.
Fragmentation (of habitat)	Interruption of large expanses of one type of habitat or vegetation by man-made clearings. Generally used where roads or areas of cropland are cleared within forested areas, thereby breaking a large continuous area of forest into smaller parcels of forest.
Flake debitage	The flake waste that results from the manufacture of stone tools.

Floodplain	The lowland and relatively flat areas adjoining inland waters, including the area that is subject to a one percent or greater chance of flooding in any given year. Level land that may be submerged by floodwaters. A plain built up by stream deposition.
Forb	Any herbaceous flowering plant, other than a grass; especially one growing under range conditions.
Fugitive emissions	Emissions of any pollutant, including fugitive dust, that do not pass through a stack, chimney, vent, or a functionally equivalent opening and are generated by activities necessary for the continued operation of the source.
Grazing preference	The total number of animal unit months (AUMs) of livestock apportioned and attached to property owned or controlled by a permittee or lessee for grazing on public lands.
Groundwater basin	A groundwater reservoir that is separated from adjacent groundwater reservoirs by geologic boundaries or by hydrologic boundaries.
Groundwater table	The upper surface of zone of saturation.
Guzzlers	A catchment basin that collects and retains water from precipitation for use by wildlife, wild horses and/or livestock.
Head (hydraulic)	The height above a standard datum (usually Mean Sea Level) of the surface of a column of water in a well.
Headward erosion	The fairly rapid, upstream movement of gullies or stream channels in response to flowing water.
Herbaceous	Plants with no persistent woody stem above the ground. Forbs such as lupines and grasses are herbaceous.
Herd Management Area (HMA)	An area established for maintenance of wild horses and burros as per the Wild Horse and Burro Act of 1971.
Hydraulic gradient	The slope of the groundwater table. A change in the static pressure of groundwater, expressed in terms of the height of water above a datum per unit of distance in a given direction.
Hydric soil	A soil that is saturated, flooded or ponded long enough during the growing season for plants to develop anaerobic (oxygen deficient) conditions in the upper part of the soil.

Hydrocarbons	Compounds containing hydrogen and carbon atoms; volatile forms are often principle causes of air pollution.
Hydrology	The study of water, its properties, and its movement.
Hydrophytic (vegetation)	Plants that grow in water or in saturated soils that are periodically deficient in oxygen as a result of high water content.
Infiltration	Used in reference to water from a stream or from precipitation entering the soil and percolating through the pore spaces and unconsolidated material, sometimes reaching the groundwater.
Inter-basin transfer of water	Transfer of water (ground or surface) from one hydrographic basin to another.
Intermittent stream	A stream that flows time during part of the year, generally in response to periods of heavy runoff either from snowmelt or storms.
Inversion	An atmospheric condition where a lower layer of cool air is trapped below an upper layer of warm air.
Ion	An atom that carries a positive or negative electric charge.
Isolate	A cultural object or feature that is isolated from other such objects, i.e. a projectile point without associated flakes.
Jurisdictional wetland	An area that meets the criteria established by the U.S. Army Corps of Engineers for a wetland (as set forth in their Wetlands Delineation Manual). Such areas come under the jurisdiction of the Corps for permitting of certain actions such as dredge and fill operations.
Lacustrine	Pertaining to, produced by, or inhabiting a lake. Lacustrine wetlands are greater than 20 acres have less than 30 percent cover of persistent vegetation.
Late seral condition	Synonymous with good ecological conditions.
Lek	A strutting ground for sagegrouse where males enact their mating displays to attract females and where mating takes place.
Lithic scatters	A surface distribution of stone flakes and tools, indicative of aboriginal stone knapping activities.
Littoral	Pertaining to a shore (as in a lake shore) or coastal area, (as in a littoral wetland).

Loam	A soil consisting of a friable mixture of varying proportions of clay, silt, and sand.
Logistical camp	A temporary campsite by a small group of aboriginal people for the primary purpose of extracting one or more specific resources; for example, a camp near a stone quarry used briefly while acquiring materials for making stone tools.
Metate	A large flat stone on which grain and hard plant seeds are ground by hand using a smaller hand-held stone (mano).
Meteoric water	Water that has its origin as precipitation.
Micromhos	A unit of conductivity; the inverse of resistance (ohms).
Microgram	Metric unit of mass equal to one-millionth of a gram; $1 \times 10^{-6} \text{g}$
Mid Seral condition	Synonymous with fair ecological conditions.
Mitigation	Actions taken to minimize or avoid the adverse effects of an action.
Negotiated Settlement Act	A congressional act that mandates the Secretary of the Interior to negotiate a new Operating Agreement for reservoirs on the Truckee River.
Neothermal	A paleoclimatologic term that refers to the Holocene, which is the terminal period of the Pleistocene; the last 10,000 years.
Non-point source	A source of pollutants that does not have one defined point. The term is generally used with reference to large areas of cleared land that are <i>non-point sources</i> of dust or to large areas of urban land from which runoff entering a stream constitutes a <i>non-point source</i> of various water pollutants.
Non-potable	Used to describe water that is not suitable for drinking.
NO _x	Oxides of nitrogen, specifically NO and NO ₂
Off-Road vehicle (ORV)	Any motorized vehicle capable of traveling over natural terrain. Includes motor cycles and four-wheeled vehicles.
Orr Ditch decree	A tabulation or adjudication of water rights from the Truckee River and its tributaries regulated through a series of reservoirs and irrigation canals, administered by the U.S. District Court Water Master in Reno.

Ozone	A secondary air pollutant consisting of three oxygen atoms. It is produced by hydrocarbons and nitrogen oxides in the presence of ultraviolet light.
PM ₁₀	The portion of fugitive dust small enough to be inhaled by humans thereby posing a health risk. Dust particles smaller than 10 microns.
Palustrine	Used in the wetlands classification system by the U.S. Fish and Wildlife Service to refer to wetlands that are vegetated--dominated by trees, shrubs, herbaceous plants, mosses or lichens.
Particulates	Fine particles that can be suspended in the air; an air pollutant (see PM ¹⁰).
Patented claim	Land originally belonging to the federal government of which the minerals and surface ownership of the land have been purchased by a private party under the provisions of the Mining Law of 1872.
Perched groundwater	Groundwater separated from an underlying body of groundwater by an unsaturated zone.
Perennial	Present at all seasons of the year.
Perennial streams	Streams that flow all year.
Perennial yield	The amount of water that can be withdrawn from a groundwater basin annually without producing an undesired result. Same as safe yield.
Periphyton	Organisms (as some algae) that live attached to underwater surfaces.
pH	A measure of acidity or basicity.
Phreatophytes	Plants that require groundwater for their survival.
Picocuries	One trillionth (10 ⁻¹²) part of any radioactive nuclide in which 3.7 x 10 ¹⁰ disintegrations occur per second.
Pioneer plants	Plants that colonize disturbed areas as a primary stage in plant succession.
Playa	The lowest part of an arid basin that is dry and totally barren of vegetation. Clay and silt are the principal constituents at the surface of a playa.
Point source	A source of effluents small enough that it can be treated as if it were a point. A point source can be either a continuous source or a source that emits effluents for a short time.
Pore pressure	Pressure exerted by fluid in the void space of soil or rock.

Potable	Water that is suitable for consumption by humans.
Prime farmland	Land that has the best combination of physical and chemical characteristics for producing agricultural crops as determined by the Secretary of Agriculture pursuant to the Farmland Protection Policy Act of 1982. Prime farmland includes land that is being used currently to produce livestock and timber, but it excludes land committed to urban development or water storage.
Primitive and unconfined recreation	Nonmotorized and nondeveloped types of outdoor recreational activities.
Protohistoric	The period of time when it was possible for Native Americans to have been affected or influenced by European culture prior to actual direct contact with Europeans. For example, the Washoe people in northern Nevada knew of Cortez's expeditions in American prior to any contact by the Washoe with Europeans. The protohistoric period extends from 1492 up to the time of actual contact.
Public scoping	The process of soliciting public comments on the issues to be examined in environmental documents such as Environmental Impact Statements (EISs). The process can be carried out by public meetings, soliciting written comments, or both. The identification of issues, alternatives, impacts, mitigation and/or monitoring all may be addressed during scoping.
Rain shadow	A dry region on the lee side of a topographic barrier, usually a mountain range, where the rainfall is noticeably less than on the windward side.
Raptors	Birds of prey such as hawks and falcons.
Recharge (hydrologic)	The process by which water is absorbed and added to the zone of saturation, either directly into a geologic formation, indirectly by way of another formation, or indirectly through unconsolidated sediments.
Resource Management Plan (RMP)	The basic document used by the U.S. Bureau of Land Management to plan the course of management for the use and protection of all public land values, renewable resources, and supporting services.
Right-of-Way	An authorization to a party other than the landowner to use a specific piece or corridor of public land for a certain period of time and for specific projects or uses; for example, for construction and operation of roads, pipelines, transmission lines and communication sites.

Riparian area or habitat	A biological zone influenced by the presence of water. Also used to refer to vegetation that grows along streams or around springs.
Riverine	Relating to a river. Riverine wetlands occur within a confined channel and have persistent vegetation.
Rooting zone	The zone of soil into which a plant's roots penetrate. In the case of deep rooted plants, the rooting zone can extend several feet to tens of feet below the soil surface.
Rotation management	A type of grazing management system where pastures are grazed for only a portion of the year or season and rested for the remainder.
Safe yield	See "Perennial yield."
Saturated	A condition often used in reference to soils in which all voids or pore spaces between soil particles are filled with water.
Sediment yield	The total sediment outflow from a drainage basin in a specific period of time. It includes bed load as well as suspended load, and usually is expressed in terms of mass or volume per unit of time.
Sedimentary rock	Rock comprised of organic (e.g. rock salt) or clastic (e.g. sand and silt) particles.
Shorebird	One of several families of often long-legged wading birds that inhabit the seacoast and shallow fresh-water bodies including sandpipers, stilts, avocets, plovers and others.
Shrub	A woody perennial plant that is usually less than 20 feet tall at maturity, and has several erect, spreading stems.
Silty-clay	Rock particles 1/20 millimeter or less in diameter.
SIP	State Implementation Plan; a plan developed pursuant to the Clean Air Act of 1990 that describes how a state will comply with emission standards for specified air pollutants.
Socioeconomics	The study of the economic, demographic, and social interactions of humans.
Sodic (soils)	Soils having an excess concentration of sodium ions. Excess sodium results in poor aeration, slow infiltration rates, and causes serious nutritional disturbances in plants by affecting the availability of calcium, magnesium and other ions required by plants.

Songbird	A large diverse group (Order Passeriformes) of small land birds with three toes in front and one in back, that are adapted for perching. Most are excellent singers. Songbirds include, as examples, robins, warblers, blackbirds and sparrows.
Steady-state conditions	See "Equilibrium conditions."
Storage coefficient	The volume of water an aquifer releases from or takes into storage, per unit surface area of the aquifer, per unit change in head.
Subsidence	The usually imperceptible sinking of the land due to such things as excessive groundwater pumping.
TDS	Total dissolved solids; all the solids (usually mineral salts) that are dissolved in water. Used to evaluate water quality.
Threatened Species	Plant and animals designated by the U.S. Fish and Wildlife Service pursuant to the Endangered Species Act of 1973. A threatened species is "any species which is likely to become an endangered species within the foreseeable future".
Tilapia	A group of predatory fish in the genus <i>Tilapia</i> that are not native to the U.S. but have been introduced in many areas to control algae.
Tuffs	A volcanic rock composed of ash particles.
Understory	Plants growing beneath the canopy of other plants. Usually refers to grasses, forbs, and low shrubs under a tree or shrub overstory.
Unpatented claim	A mining claim located on public land for which the claimant does not own the land. Holders of unpatented claims have the statutory right under the 1872 Mining Law, and consistent with other federal laws and regulations, to explore for, develop and extract mineral resources on public land.
Unsaturated zone	The zone between the land surface and the water table.
Visitor Day	Any combination of on-site recreational activities totalling 12 hours (e.g. one person for 12 hours or 12 people for one hour).

Visual Resource Management (VRM)	The VRM system is an analytical process that identifies, sets, and meets objectives for maintaining the visual quality of public lands. The system is based on research that has identified ways to assess aesthetic qualities of the landscape and public concern for these qualities.
Weir	A dam in a stream to raise its water level, divert its flow, or measure its flow.
Wetland	A wetland is an area with saturated soil or substrate during all or a significant portion of the growing season. Saturation with water affects soil development and the kinds and plants and animals living in the soil or on its surface.
Wild horse herd use area	The geographic area which a herd currently uses as its habitat, contrasted with a Herd Management Area (HMA), which is an area established for maintenance of wild horses or burros.
Wilderness values	Values established in the Wilderness Act, such as solitude and naturalness.
Wilderness Study Area (WSA)	An area possessing wilderness characteristics as defined in the Wilderness Act, and identified pursuant to the Federal Land Policy and Management Act of 1976. These areas are maintained in their original condition and evaluated for possible inclusion in the National Wilderness Preservation System.
Winter range	Areas used by migratory wildlife such as muledeer, during the winter months. Typically these areas are low in elevation and have a shrub layer available to provide cover and forage.
Xeric shrubs	Shrubs that are adapted to survive in areas of low precipitation.
Xeriscape	Landscaping with native and naturalized plant species that are adapted to survive in areas of low precipitation.

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APPENDIX A

AIR QUALITY

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A. EVALUATION OF AIR QUALITY IMPACTS FROM PIPELINE CONSTRUCTION

Three sources of fugitive dust emissions would occur during pipeline construction, as follows: (1) directly from construction activities, (2) exhaust emissions from construction vehicles, and (3) wind erosion from construction sites. Each is described below.

(1) Fugitive Dust Emissions from Construction Activities

Emissions of fugitive dust would occur during land clearing, trench excavation and backfilling of the trenches, movement of heavy equipment, and other operations associated with installing the pipelines. The emission factor in EPA's AP-42 document for suspended dust emissions from construction activities is 1.2 tons per acre per month (EPA, 1990a). To determine PM₁₀ emissions, a particle size multiplier of 0.5 was used (EPA, 1990a), so that PM₁₀ emissions from construction of the pipeline are estimated to be 0.6 tons/acre-month.

Construction of the water pipeline is projected to occur on a 100 foot wide right-of-way at a pace of 250 feet per day. In order to develop a worst-case day scenario, it was assumed that construction would proceed 20 percent faster than the average, or 300 feet per day. Thus PM₁₀ emissions on the worst-case day (E₁₀) are estimated to be:

$$\begin{aligned} E_c &= 0.6 \text{ tons/month/acre} \times 1/30 \text{ month/day} \times (300 \text{ ft} \times 100 \text{ ft})/43,560 \text{ ft}^2/\text{acre} \\ &= 0.0138 \text{ tons/day} \\ &= 0.348 \text{ gm/sec (based on 10-hr construction day)} \\ &= 1.25 \times 10^{-4} \text{ gm/m}^2\text{-sec (average PM}_{10}\text{ emissions/m}^2\text{ over the construction site)} \end{aligned}$$

(2) Exhaust Emissions from Construction Equipment

Estimates of exhaust emissions from equipment to be used during construction of the pipelines are listed on Tables A-1 and A-2.

(3) Wind Erosion from Construction Sites

Fugitive dust emissions from wind erosion were estimated using procedures from EPA, 1990b and EPA, 1985a. Exposed soil in the vicinity of the pipeline routes is characterized as having a "limited reservoir" of erodible material, based on the evaluation criteria in EPA (1985a), the data contained in Section 3.1 of the EIS, and a site visit. Wind erosion at such sites occurs principally at wind speeds greater than ≥ 10 m/sec measured at a seven meter height (EPA, 1985a).

TABLE A-1

EMISSION FACTORS^(a) FOR SPECIAL CONSTRUCTION EQUIPMENT USED ON TRUCKEE MEADOWS PROJECT

Emission Source	Horsepower (hp)	Load Factor	CO Emissions		HC Emissions		NO _x Emissions		SO ₂ Emissions		PM-10 Emissions	
			Emission Factor (lb/hp-hr)	Emissions Rate (lb/hr)	Emission Factor (lb/hp-hr)	Emissions Rate (lb/hr)	Emission Factor (lb/hp-hr)	Emissions Rate (lb/hr)	Emission Factor (lb/hp-hr)	Emissions Rate (lb/hr)	Emission Factor (lb/hp-hr)	Emissions Rate (lb/hr)
Arc Welder #1	65	0.77	0.0067	0.3340	0.0025	0.1234	0.0309	1.5431	0.0021	0.1026	0.0022	0.1102
Arc Welder #2	40	0.75	0.0067	0.2004	0.0025	0.0741	0.0309	0.9259	0.0021	0.0616	0.0022	0.0662
Well Test Pump	100	1.00	0.4387	43.8700	0.0147	1.6910	0.0114	1.1400	0.0006	0.0591	0.0007	0.0721
Vibratory Compactor	5	1	0.4387	2.1935	0.0147	0.2945	0.0114	0.0570	0.0006	0.0030	0.0007	0.0036

^(a) Emission factors are from EPA (1985b).Abbreviations are as follows: CO = carbon monoxide; HC = hydrocarbons; NO_x = oxides of nitrogen (NO + NO₂); SO₂ = sulfur dioxide; PM₁₀ = particulates <10 microns in diameter (inhalable dust).

TABLE A-2

EXHAUST EMISSION RATES^(a) FROM VEHICLES AND OTHER EQUIPMENT USED TO CONSTRUCT THE PIPELINES

Emission Source	Hours of Operation	CO Emissions		HC Emissions		NOx Emissions		SO ₂ Emissions		PM-10 Emissions	
		Emissions Rate (lb/hr)	Total Emissions (lb)	Emissions Rate (lb/hr)	Total Emissions (lb)	Emissions Rate (lb/hr)	Total Emissions (lb)	Emissions Rate (lb/hr)	Total Emissions (lb)	Emissions Rate (lb/hr)	Total Emissions (lb)
Bulldozer	1,888	0.346	653	0.12	228	1.26	2,379	0.14	259	0.11	211
Wheeled Loaders	20,170	0.572	11,537	0.25	5,043	1.89	38,121	0.182	3,671	0.172	3,469
Motor Grader	400	0.151	60	0.04	16	0.713	285	0.086	34	0.061	24
Off-Hwy Truck	8,452	1.794	15,163	0.0192	162	4.166	35,211	0.454	3,837	0.256	2,164
Vibratory Roller	32	13.400	429	0.795	25	6.48	207	0.02	1	0.026	1
Vibratory Compactor	18,548	2.194	40,685	0.2945	5,462	0.057	1,057	0.002955	55	0.003605	67
Miscellaneous	5,438	0.675	3,671	0.152	827	1.691	9,196	0.143	778	0.0139	76
Arc Welder #1	27,200	0.334	9,084	0.12	3,358	1.54	41,973	0.103	2,791	0.110	2,999
Arc Welder #2	12,208	0.200	2,446	0.07	904	0.93	11,304	0.062	752	0.066	808
Well Test Pump	720	43.870	31,586	1.69	1,218	1.14	821	0.059	43	0.072	52
Personal Vehicles/Vans	12,000	1.019	12,222	0.079	952	0.053	635	n/a	0	n/a	0
Pickups	5,980	0.917	5,484	0.093	554	0.049	290	n/a	0	n/a	0
Total Emissions											
(lb/9 month)			13,3021		18,749		141,479		12,219		9,870
(ton/9 month)			66.51		9.37		70.74		6.11		4.94

^(a) Emission factors are from EPA (1985b).Abbreviations are as follows: CO = carbon monoxide; HC = hydrocarbons; SO₂ = sulfur dioxide; NO_x = oxides of nitrogen (NO + NO₂); PM₁₀ = particulates < 10 microns in diameter (inhalable dust)

Emissions were calculated using the following equation:

$$E_{wc} = (0.83 \times f \times P(u^+) \times (1-V))/(PE - 50)^2$$

where:

E_{10}	=	PM_{10} emission rate (mg/m ² -hr)
f	=	frequency of disturbance per month (worst-case 24-hr average equal to 30 (EPA, 1985a))
V	=	fraction of surface area covered by continuous vegetative cover (assumed to be 0 for the pipeline right-of-way during construction)
PE	=	Thornthwaite's Precipitation Evaporation Index, used as a measure of average soil moisture content ($PE = 20$ for Washoe County (EPA, 1985a))
$P(u^+)$	=	erosion potential
	=	$6.7 (u^+ - u_t)$

where:

u^+	=	observed fastest mile of wind for the period between disturbances (m/sec)
u_t	=	erosion threshold wind speed (m/sec) measured at a typical weather station sensor height of 7 m

The value used for u^+ was 35.8 m/sec (NOAA, 1991). The value used for u_t was 17.0 m/sec, based on a threshold friction velocity for overburden of 1.02 m/sec (EPA, 1990b), converted to the equivalent wind speed at 7 meters (EPA, 1985a).

$$E_{wc} = 3.48 \text{ mg/m}^2\text{-hr}$$

$$= 9.68 \times 10^{-7} \text{ g/m}^2\text{-sec}$$

The total PM_{10} emissions rate at pipeline construction sites is therefore:

$$E_t = \text{construction emissions} + \text{exhaust emissions} + \text{wind erosion}$$

$$= 1.25 \times 10^{-4} \text{ gm/m}^2\text{-sec} + 5.76 \times 10^{-8} \text{ gm/m}^2\text{-sec} + 9.68 \times 10^{-7} \text{ gm/m}^2\text{-sec}$$

$$= 1.25 \times 10^{-4} \text{ gm/m}^2\text{-sec}$$

To determine the impact, PM_{10} emissions were used as input in EPA's Industrial Source Complex Short Term (ISCST) air quality dispersion model (EPA, 1987). The model was run in a 24-hour averaging mode to provide a comparison with the PM_{10} NAAQS. Emissions from one day of construction were simulated by using three square area sources with dimensions of 30.48 meters. The modeling also included wind erosion from the previous day's construction area, even though PM_{10} emissions from wind erosion at the construction site were shown to be more than two orders of magnitude lower than PM_{10} emissions from construction activity.

A worst-case scenario of site conditions was used in the air dispersion modeling, as follows:

- 1) Steady winds blowing along the pipeline rights-of-way to maximize the impact of fugitive dust emissions to receptors. Winds were set at 2.5 m/sec with "F" (very stable) atmospheric stability conditions. These conditions were recommended by EPA as worst-case conditions at sites where mechanical resuspension of fugitive dust is a major factor (EPA, 1985a).
- 2) Construction was assumed to operate for 10 hours a day. During periods of construction activity, site emissions were the sum of construction, exhaust and wind erosion emissions. For the other 14 hours, the only site emissions were from wind erosion.
- 3) No controls on air emissions resulting from the construction activity (e.g., watering) were assumed for this analysis.
- 4) Receptors were defined in concentric rings in a polar grid system surrounding the site, with receptor distances varying between 50 and 1600 meters.

With winds blowing steadily along the pipeline route, fugitive dust emissions caused 24-hour average PM_{10} concentrations to exceed the NAAQS of $150 \mu\text{g}/\text{m}^3$ for a distance of 400 meters along the pipeline route. PM_{10} concentrations for 24-hour averages at distances of 800 meters and 1600 meters are predicted to be 60 and $22 \mu\text{g}/\text{m}^3$, respectively. It is emphasized that these are worst-case predicted PM_{10} concentrations, expected to occur at any location for only one day, moving as the pipeline is constructed. In addition, the pipeline is being constructed in very sparsely populated areas; not only would the impact be temporary, but there is minimal population in the area to be impacted.

An additional modeling run was conducted to determine the extent of the impact away from the pipeline. All modeling input parameters discussed above were unchanged except for the wind direction, which was rotated 90 degrees so that the wind was blowing perpendicular to the pipeline route rather than along the route. As expected, impacts were much lower; the NAAQS for PM_{10} was exceeded for only 120 meters from the pipeline route.

The outputs for these two ISCST modeling runs are available upon request from the BLM.

B. EVALUATION OF AIR QUALITY IMPACT FROM VEGETATION LOSS IN HONEY LAKE VALLEY

The black greasewood on 13,000 acres in Honey Lake Valley could be reduced due to groundwater pumping for the *Truckee Meadows Project* (Section 4.5 of this EIS). Part of the affected black greasewood community could be re-colonized by non-phreatophytic shrubs from the nearby shadscale vegetation communities. The balance of the affected area would be expected to change through succession to a cover of primarily annual grasses and forbs. Air quality impacts that could result from a loss of vegetative cover would be an increase in direct exposure of bare soils to wind, with a potential increase in wind erosion. This

analysis assumes a worst theoretical case; that is, the impact if the entire 13,000 acres of greasewood were eliminated. This is not likely to happen, as described in Section 4.5 of this EIS.

Fugitive emissions from wind erosion in Honey Lake Valley were determined by using an approach similar to the analysis of fugitive emissions along the pipeline routes (Part A of this appendix).

Exposed soil in the section of Honey Lake Valley where black greasewood is located is characterized as having a "limited reservoir" of erodible material, based on the evaluation criteria in EPA (1985a), the data contained in Section 3.1 of the EIS, and a site visit. Wind erosion at such sites occurs principally at wind speeds greater than ≥ 10 m/sec measured at a seven meter height (EPA, 1985a).

The increase in particulate emissions resulting from the worst-case loss of vegetation was calculated using the following equation:

$$E_{wc} = (0.83 \times f \times P(u^+) \times (V_1 - V_2)) / (PE - 50)^2$$

where:

E_{10}	=	PM ₁₀ emission rate (mg/m ² -hr)
f	=	frequency of disturbance per month (worst-case 24-hr average equal to 30 (EPA, 1985a))
V_1	=	fraction of surface area covered by vegetative cover before groundwater pumping begins for the Truckee Meadows Project (assumed to be 0.25)
V_2	=	fraction of surface area covered by vegetative cover after maximum impact from groundwater pumping has occurred (assumed to be 0.0).
PE	=	Thornthwaite's Precipitation Evaporation Index, used as a measure of average soil moisture content (PE = 20 for Washoe County (EPA, 1985a))
$P(u^+)$	=	erosion potential
	=	$6.7 (u^+ - u_t)$

where:

u^+	=	observed fastest mile of wind for the period between disturbances (m/sec)
u_t	=	erosion threshold wind speed (m/sec) measured at a typical weather station sensor height of 7 m

The value used for u^+ was 35.8 m/sec (NOAA, 1991). The value used for u_t was 17.0 m/sec, based on a threshold friction velocity for overburden of 1.02 m/sec (EPA, 1990a), converted to the equivalent wind speed at 7 meters (EPA, 1985a).

$$\begin{aligned} E_{wc} &= 0.871 \text{ mg/m}^2\text{-hr} \\ &= 2.42 \times 10^{-7} \text{ g/m}^2\text{-sec (incremental increase in emissions)} \end{aligned}$$

To determine the impact of these PM₁₀ emissions, they were used as input in EPA's Industrial Source Complex Short Term (ISCST) air quality dispersion model (EPA, 1987). The model was run in a 24-hour averaging mode to provide a comparison with the PM₁₀ NAAQS. Figure 4.6-1 shows the area of black greasewood that could potentially be impacted.

The worst-case emissions scenario was simulated by finding the longest continuous distance (fetch) over which the wind could travel over the area which could potentially have denuded soil in the future. This distance is in a northwest-southeast line just northeast of the playa near Fish Springs Ranch (Figure 4.6-1). Under this scenario, the wind could travel 9650 meters (approximately 5 miles) across denuded soil over the former black greasewood community.

This path was simulated in the model by a series of squares (area sources are required to be input as squares by ISCST), whose dimensions totaled 1609 meters across and 9650 meters in distance. One minor modification was included in the modeled depiction of the area: the path across the bare soil surface was rotated in the model from a northwest-southeast direction to a north-south direction, in order to simplify the depiction of the path in the model. The wind was also rotated so that in the worst-case hypothetical event it blew continuously from the north, in order to maintain the maximum fetch across the denuded soil.

The receptors were placed on the centerline of the path, starting 25 meters from the southern boundary of the denuded area and extending to the south for 1600 meters. Finally, the source area was subdivided into 168 smaller squares (as small as 25 meters on a side), with the smallest squares located at the southern boundary. This was done to keep the source-receptor separation equal to or less than the distance along one side of the area sources, as recommended in the ISCST Users Guide (EPA, 1987).

A worst-case scenario of site conditions was used in the air dispersion modeling: steady winds blowing directly along the denuded soil path to suspend the maximum amount of fugitive emissions, resulting in the highest PM₁₀ impact on the receptors. Winds were set at 4.3 m/sec with "E" (stable) atmospheric stability conditions. This approach follows EPA recommendations at sites where wind erosion is the major contributor of fugitive dust (EPA, 1985a).

With winds blowing steadily across the denuded soil for a 24-hour period, the highest predicted increase in 24-hour average PM₁₀ concentrations was 14.4 µg/m³ at a distance of 25 meters from the southern boundary of the former black greasewood area. This worst-case impact, based on a reduction of vegetative cover from the current 25 percent to 0 percent, is approximately 10 percent of the PM₁₀ NAAQS of 150 µg/m³. The predicted air quality impact decreases steadily, and is less than 10µg/m³ at a distance of 500 meters.

The output for this ISCST modeling run is available upon request from the BLM.

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APPENDIX B

SURFACE WATER HYDROLOGY

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TABLE B-1
STREAM FLOW DATA AND RELATED INFORMATION FOR STREAMS
TRIBUTARY TO HONEY LAKE VALLEY (from Rockwell, 1990)

USGS Station Number ^(a)	Station Name	Drainage Area (sq. mi)	Mean Annual Flow ^(b) (cfs)	Period of Record
10353950	Spencer Cr. near Herlong, CA	4.7	0.5R	1988
10353860	Skedaddle Cr. near Herlong, CA	83.4	6.9R	1988
10353970	Cottonwood Cr. near Flanigan, NV	14.6	2.2C	1988
10353965	Gasperoni Cr. near Flanigan, NV	1.2	0.1C	1988
10353971	Rock Springs Cr. near Flanigan, NV	2.5	0.3R	1988
10353972	Milne Creek near Flanigan, NV	2.3	0.3R	1988
10353975	Willow Springs Cr. near Flanigan, NV	0.8	0.2C	1988
10353976	Fish Springs Cr. near Flanigan, NV	3.7	0.4C	1988
10353977	Antoinette Cr. near Flanigan, NV	0.8	0.1C	1988
10353977	Butler Cr. near Flanigan, NV	0.5	0.1C	1988
10353978	Mullen Cr. near Flanigan, NV	0.5	0.2C	1988
10353980	Fort Sage Cr. near Flanigan, NV	1.6	0.6C	1988
10354000	Long Valley Cr. near Scotts, CA	125.0	11.0C	1917-19, 1988
10354450	Willow Ranch Cr. near Dolye, CA	7.1	2.9C	1988
10354670	McDermott Cr. near Milford, CA	3.6	1.5C	1988
10354700	Mill Cr. at Milford, CA	2.3	2.8C	1963-69, 1988
10354800	Hallett Cr. near Buntingville, CA	2.2	0.6C	1988
10354900	Parker Cr. at Highway 395 (Bunt.), CA	2.9	0.7C	1988
-----	Elysian Cr. near Janesville, CA	10.8	4.9C	1988
10354950	Baxter Cr. near Johnstonville, CA	4.4	2.3C	1988
10355500	Sloss Cr. near Janesville, CA	1.1	0.6R	1915, 1918-19
10356000	Bankhead Cr. near Janesville, CA	1.8	1.0R	1915, 1918-19
10356500	Susan River at Susanville, CA	184.0	98.7G	1900-06, 1917-21, 1951-88
10356700	Paiute Cr. at Susanville, CA	26.3	4.7C	1988
10356900	Gold Run Cr. near Susanville, CA	7.0	6.1C	1957-88
10356950	Hills Cr. near Susanville, CA	2.5	2.2C	1988
10357400	Lassen Creek above Co. Rd 205 near Susanville, CA	2.5	1.4C	1988
10357500	Willow Cr. near Susanville, CA	90.4	34.7G	1951-88
10358600	Petes Cr. near Litchfield, CA	140.0	11.0R	1988
10358650	Balls Canyon Cr. near Litchfield, CA	370.0	26.0R	1988
10355910	Shaffer Cr. near Litchfield, CA	5.6	0.2G	1963-73, 1988

^(a) US Geological Survey Station identification; the symbol "---" indicates that no USGS number has been assigned.

^(b) Mean Annual Streamflow: cfs = Cubic feet per second

C = Estimated on the basis of monthly measurements and correlation with gaged streams;

G = Based on long-term gaging station record;

R = Estimated on basis of relation between drainage area and runoff.

TABLE B-2

MEAN ANNUAL STREAMFLOW TO HONEY LAKE VALLEY, NEVADA-CALIFORNIA
(from USGS, 1990)

Basin Segment	Drainage Area ^(a) (sq. mi)	Streamflow ^(b) (Acre-Feet)
North and East (Skedaddle Mountains and Virginia Mountains, NV)	168.0	13,000
Southeast (Dry Valley Cr. near Doyle to Willow Ranch Cr. near Doyle, excluding Long Valley Cr.)	135.0	8,400
Long Valley Creek near Doyle, CA	266.0	17,000
South and West (Willow Ranch Cr. near Doyle, CA to Willow Cr. near Susanville, CA excluding the Susan River)	282.0	90,000
Susan River at Susanville, CA (gaged)	184.0	69,000
Northwest (between Willow Creek and Spencer Creek, CA)	<u>565.0</u>	<u>31,000</u>
TOTAL:	1,600	230,000
^(a) Rounded to three significant figures. ^(b) Rounded to two significant figures.		

TABLE B-3^(a)

SPRINGS/SEEPS AND WELLS

(The springs, seeps, and wells are grouped into geographic areas for evaluation purposes)

JBR Map ID	Spring Name	Conductivity (mhos/cm ²) ^(b)	pH	Flow (gpm) ^(c)	Temp °C
East Cottonwood Canyon (four to six miles east of Fish Springs Ranch)					
6	Not Named	230	7.8	1	8
7	East End Spring	200	7.8	13	16
8	Lower East End Spring	300	6.6	<1	16
9	East Cottonwood Bog	210	6.6	---	12
10	E. Middle Cottonwood	200	7.4	16	16
11	E. Middle Springs 2&3	---	Not Measured	---	---
12	Middle Open Cottonwood	190	7.5	36	18
13	Little Open Spring	200	7.9	2	19
14	Middle Rose Spring	200	7.7	7	18
15	Big Middle Cottonwood	200	7.8	42	18
16	Little Middle Cottonwood	190	6.6	2	14
17	Middle Thorny Spring	190	6.9	30	16
18	Willow Run Spring	205	7.8	8	6
19	Pipeline Spring	205	8.0	4	16
20	M. & E. Cottonwood Hill	230	7.6	2	6
21	West Cottonwood Hillside	---	Not Measured	---	---
23	Aspen Seep Spring	230	7.4	<1	11
30	Not Named	230	8.1	<1	
148	Not Named	200	7.6	9	6
149	Not Named	200	7.8	<1	7
Average:		212	7.5	---	13
Cottonwood Canyon (three to four miles east of Fish Springs Ranch)					
22	Great Tangle Spring	270	6.7	11	11
24	Grassy Step Spring	200	7.6	<1	14
25	Not Named	---	Not Measured	---	---
26	Not Named	225	7.7	3	8
27	Not Named	220	6.9	2	7
28	Not Named	---	7.4	4	7
29	Not Named		7.2	10	6
59	Not Named	200	7.2	2	4
60	West Cold Spring	230	6.7	2	9

TABLE B-3^(a)

SPRINGS/SEEPS AND WELLS

(The springs, seeps, and wells are grouped into geographic areas for evaluation purposes)

JBR Map ID	Spring Name	Conductivity (mhos/cm ²) ^(b)	pH	Flow (gpm) ^(c)	Temp °C
Northern Virginia Mountains					
61	Cold Spring	240	---	10	7
62	Upper Cold Spring	320	7.4	<1	8
63	Frozen Spring	---	Frozen	---	---
	Average:	238	7.2	---	8
1	Willow Spring	200	7.6	17	16
2	Lower Juniper Basin	---	Not Measured	---	---
3	Middle Juniper Basin	---	Not measured	---	---
4	Upper Juniper Basin	545	7.5	<1	8
5	Telephone Pole Canyon	540	7.3	4	13
31	Upper Adobe Spring	675	7.5	<1	7
32	Middle Adobe Spring	760	8.1	<1	8
33	Lower Adobe Spring	760	7.6	<1	11
34	Shallow Spring	810	8.1	1	12
35	Lower NE VA's Canyon	1140	7.2	<1	6
36	Aspen Corral Creek	240	7.9	26	3
37	Big Canyon Creek	270	8.2	18	4
38	Water Tank Spring	---	Not Measured	---	---
39	Black Tank Spring	280	7.8	6	8
40	Big Chokecherry Spring	220	7.2	<1	13
41	Old Tank Spring	390	6.9	<1	8
	Average:	525	7.6	---	9
Fort Sage Mountains					
42	Sheep Trough Spring	250	7.4	<1	13
43	Fish Canyon Spring #1	280	7.8	<1	3
44	Fish Canyon Spring #2	300	7.0	4	7
45	Tie Trough NE Spring	340	7.1	12	15
46	Tie Trough Seep	390	7.4	<1	15
47	Tie Trough NW Spring	225	8.1	8	10
48	Tie Trough SW Spring	225	7.1	3	15
49	Tie Trough SE Spring	310	7.4	2	19
50	Willow Chute Spring	400	7.1	<1	12
51	Fort Sage Mud Spring	420	7.5	<1	5
52	Around The Hill Spring	310	8.1	<1	3
53	Upper Fort Sage Mud	205	---	<1	14

TABLE B-3^(a)

SPRINGS/SEEPS AND WELLS

(The springs, seeps, and wells are grouped into geographic areas for evaluation purposes)

JBR Map ID	Spring Name	Conductivity (mbos/cm ²) ^(b)	pH	Flow (gpm) ^(c)	Temp °C
Fort Sage Mountains (Continued)					
54	Bullfrog Spring	400	7.7	<1	10
55	LaRue Spring	450	6.9	>1	6
56	Juniper Ring Spring	610	6.8	<1	13
57	Upper Fort Sage Willow	525	7.2	<1	11
58	Lower Fort Sage Willow	600	7.3	<1	6
80	Bootlegger Spring	1060	8.1	>1	9
150	Indian Spring	410	7.4	<1	9
153	Willow Spring	410	7.0	>1	9
154	Jesus Spring	200	6.8	>1	13
156	Stateline Spring	260	6.8	<1	11
157	High North Spring	210	7.2	<1	9
158	North Fort Sage Creek	275	6.7	8	11
	Average:	377	7.3	---	10
Black Canyon (three miles north of Winnemucca Valley)					
65	Black Canyon #1	250	8.7	2	13
66	Black Canyon #2	240	7.9	<1	12
67	Peach Spring	240	8.1	<1	13
68	Surprise Spring	280	7.4	3	12
69	Black Canyon #3	265	8.3	4	12
72	Upper Blue Spring	300	7.7	2	11
73	Lower Blue Spring	390	7.4	2	11
74	Upper Red Spring	300	---	26	14
75	Lower Red Spring	305	7.2	2	12
76	Long Spring	305	7.8	2	10
110	Ranch Spring #4	315	7.7	<1	14
111	Ranch Spring #2	360	7.7	3	9
112	Ranch Spring #1	325	8.4	<1	7
113	Ranch Spring #3	450	7.7	---	11
114	Bumpy Spring	360	7.5	5	13
115	Violet Spring	300	7.0	<1	11
116	West Corral Spring	---	Not Measured	---	---
	Average:	281	7.9	---	11

TABLE B-3^(a)

SPRINGS/SEEPS AND WELLS

(The springs, seeps, and wells are grouped into geographic areas for evaluation purposes)

JBR Map ID	Spring Name	Conductivity (mhos/cm ²) ^(b)	pH	Flow (gpm) ^(c)	Temp °C
Newcombe Dry Lake Area (extends several miles to south)					
64	Newcombe Spring	300	7.3	12	20
70	Upper Stonewall Spring	455	7.1	<1	13
71	Lower Stonewall Spring	455	7.1	<1	13
	Average:	403	7.2	---	15
Spanish Flat/Scott Springs Area (four to five miles north and east of Winnemucca Valley)					
77	Virginia Mountains Mud Spring	125	6.9	<1	6
78	Middle and Lower Scott	175	7.8	---	6
79	Upper Scott Spring	200	7.1	2	7
	Average:	167	7.3	---	6
Dry Valley/Seven Lakes Mountain (south of Fort Sage Mountains)					
81	Dry Valley Pools	1000	8.2	3	6
82	Lower Dry Valley	765	8.2	21	8
83	Miller Spring #1	270	7.2	>1	4
84	Upper Miller Spring #1	350	7.4	>1	3
85	Hubbard Spring #1	200	7.0	>1	16
86	Duckweed Spring	340	6.4	<1	14
87	-----	---	---	---	---
88	Hubbard Spring #2	200	7.4	3	18
89	Contact seep	330	6.9	<1	7
90	Wild Rose Spring	250	7.7	<1	18
91	Leaking Bench Spring	260	7.5	1	10
92	Nettle Spring	300	7.7	4	12
93	Colorcrop Spring	400	7.9	<1	3
94	Headwaters Spring	340	7.6	16	12
95	Diverging Spring	345	7.4	3	13
96	Rusty Hinge Spring	450	7.4	1	11
97	Five Tanks Spring	170	6.6	1	18
98	Lowest below 5 Tanks	300	7.1	<1	16
99	Seep in Section 23	360	7.4	<1	15
100	West Gooseberry Spring	195	7.2	<1	19
101	Mid-Gooseberry Seep	390	6.7	<1	20
102	Steele Spring	---	Not Measured	---	---
103	NE of Gooseberry Area	1170	7.5	<1	16
104	Spring and Creek NE of Gsbry.	1200	7.9	<1	16

TABLE B-3^(a)

SPRINGS/SEEPS AND WELLS

(The springs, seeps, and wells are grouped into geographic areas for evaluation purposes)

JBR Map ID	Spring Name	Conductivity (mhos/cm ²) ^(b)	pH	Flow (gpm) ^(c)	Temp °C
Dry Valley/Seven Lakes Mountain (continued)					
105	Dam & Seep @ NE 7-Lakes	470	7.2	<1	14
106	Big E. Gooseberry Spring	460	7.4	<1	19
107	East Gooseberry Spring	650	6.6	<1	22
108	East Gooseberry Seep	370	7.0	<1	14
109	East-most Lake Spring	355	7.7	<1	15
	Average:	444	7.3	---	13
Dogskin Mountain Area (north and east of Bedell Flat)					
117	Upper Wildcat	300	6.9	<1	4
118	Lower Wildcat	350	7.0	<1	6
119	Lower Dalton	225	7.2	<1	9
120	Upper Dalton	230	7.0	>1	10
121	Lower Ernie	300	7.2	<1	9
122	Upper Ernie	---	Not Measured	---	---
123	Hidden Horse	180	8.0	<1	6
124	Santana Spring	480	8.3	<1	4
125	Jackass Spring	300	7.9	<1	13
126	Higgins Spring	350	6.9	<1	20
127	Steele Spring #1	300	7.9	<1	12
128	Steele Spring #2	300	8.0	<1	11
129	Chewing Gum Spring	250	7.8	<1	---
130	Nava Spring	275	7.7	<1	15
131	Canyon Spring #6	430	8.0	<1	22
132	Canyon Spring #7	360	7.3	<1	18
133	Carl Spring	345	7.2	<1	14
134	Canyon Spring #5	310	7.3	<1	22
135	Canyon Spring #4	325	7.4	<1	19
136	Upper Canyon #3	385	7.2	<1	16
137	Lower Canyon #3	385	7.2	<1	16
138	Un-dev. Canyon #1	400	7.3	<1	17
139	Canyon Spring #2	420	7.2	<1	18
140	Canyon Spring #1	350	7.1	<1	18
141	Un-dev. Canyon #2	365	7.3	<1	19
142	Raintree Spring	440	7.4	5	15
143	Bedell Seep	225	7.4	<1	18

TABLE B-3^(a)

SPRINGS/SEEPS AND WELLS

(The springs, seeps, and wells are grouped into geographic areas for evaluation purposes)

JBR Map ID	Spring Name	Conductivity (mhos/cm ²) ^(b)	pH	Flow (gpm) ^(c)	Temp °C
Dogskin Mountain Area (Continued)					
144	Settlemyer Spring	410	8.2	2	10
145	Matley Spring	400	7.5	2	15
146	Dogskins Willow	670	8.6	<1	18
147	Bedell Spring	225	8.1	1	15
Average:		343	7.5	---	13
California Side of Eastern Honey Lake Valley					
161	Habitation Flow Well	145	8.2	3	25
162	Orchard Well	150	8.4	1	21
163	N. Honey Lake Valley Seep	175	8.6	2	16
164	Flowing Well 4021T	220	8.7	3	16
165	High Rock Spring	180	8.2	809	27
Average:		174	8.4	---	21
Smoke Creek Desert Area					
166	Soda Springs	2050	8.8	6	14
167	SE Playa Spring	---	8.4	1	16
168	Sulfur Spring	1700	6.9	---	18
169	SW Flowing Well 3891	1200	7.6	2	21
170	SW Flowing Well 3902	1200	8.0	<1	18
171	S. Fence Flowing Well	1400	8.0	142	19
172	Flowing Well S. House	2000	8.0	112	29
173	Well W. of Rd. & Ranch	2100	7.5	145	3
174	1st Well N of Round Hole	2050	7.9	4	28
175	2nd Well N of Round Hole	2200	7.9	59	27
176	Old Structure Flow Well	2900	7.5	3	3
177	Rotten Egg Spring	2500	7.6	"Large"	32
178	Flowing Well 3866	2250	7.8	---	21
179	S-most Flowing Well/Spring South of Laird Spring	2100	8.6	4	19
180	2nd Spring South of Laird Spring	2000	8.8	112	19
181	1st Flowing Well S of Laird Spring	5400	8.2	<1	18
182	1st Spring S of Laird	2600	6.4	---	16
183	Laird Spring	---	---	8	19
184	S. Buckbrush Spring	3500	7.3	<1	11
185	Buckbrush Well	2000	8.1	"Substantial"	21

TABLE B-3^(a)

SPRINGS/SEEPS AND WELLS

(The springs, seeps, and wells are grouped into geographic areas for evaluation purposes)

JBR Map ID	Spring Name	Conductivity (mhos/cm ²) ^(b)	pH	Flow (gpm) ^(c)	Temp °C
Smoke Creek Desert Area (Continued)					
186	N. Buckbrush Spring	1500	8.0	7	20
187	Dry Trough Well	---	6.6	---	18
188	Bonham Well (North)	1420	7.8	3	18
	Average:	2215	7.8	---	22
(Northern) Dry Valley Area North of eastern Honey Lake Valley)					
189	N. Lower Willow Spring	260	7.1	>1	17
190	S. Lower Willow Spring	---	---	Dry	---
191	Spring N. of Pipe Spring	---	---	Dry	---
192	Pipe Spring	195	7.7	>1	15
	Average:	228	7.4	---	16
^(a) The data presented in this table were taken from a spring and seep survey conducted for Washoe County by JBR Consultants Group (JBR, 1990a). This document is available for review at the BLM's Carson City District Office. See Section 3.3 of the main text for the locations of many of the springs and seeps listed in this table. ^(b) mhos/cm² = micromhos per square centimeter; opposite of resistance (ohms) ^(c) gpm = gallons per minute					

TABLE B-4

**DRAINAGE CROSSINGS ALONG PROPOSED WATER PIPELINE
ROUTE (Pipeline descriptions are grouped into three segments:
(1) Fish Springs Ranch; (2) Fish Springs Ranch to Hungry Valley; and
(3) Hungry Valley to Lemmon Valley)**

Drainage Name	Crossing Location
Segment 1: Fish Springs Ranch	
Cottonwood Cr. - Fork	NW ¼, Sec. 15, T26N, R19E
Cottonwood Cr. - Fork	NE ¼, Sec. 16, T26N, R19E
Cottonwood Cr. - Fork	SW ¼, Sec. 16, T26N, R19E
Not Named	NE ¼, Sec. 30, T26N, R19E
Rock Springs Creek	NW ¼, sec. 30, T26N, R19E
Anderson Canyon	SW ¼, Sec. 30, T26N, R19E
Willow Springs	SE ¼, Sec. 25, T26N, R18E
Fish Springs Creek	NE ¼, Sec. 27, T26N, R18E
Not Named	SE ¼, Sec. 26, T26N, R18E
Segment 2: Fish Springs Ranch - Hungry Valley	
Not Named	SW ¼, NE ¼, Sec. 35, T26N, R18E
Sheep Springs Creek	SE ¼, SW ¼, Sec. 35, T26N, R18E
Not Named	NE ¼, NE ¼, Sec. 2, T25N, R18E
Fish Springs Creek	NE ¼, SE ¼, Sec. 3, T25N, R18E
Not Named	SE ¼, SE ¼, Sec. 10, T25N, R18E
Not Named	SE ¼, SE ¼, Sec. 10, T25N, R18E
Not Named	NW ¼, NW ¼, Sec. 14, T25N, R18E
Not Named	SE ¼, NW ¼, Sec. 14, T25N, R18E
Not Named	SE ¼, SW ¼, Sec. 23, T25N, R18E
Not Named	SE ¼, NW ¼, Sec. 26, T25N, R18E
Not Named	NE ¼, NW ¼, Sec. 1, T24N, R18E
N. Fork, Dry Valley Cr.	SE ¼, SW ¼, Sec. 1, T24N, R19E
M. Fork, Dry Valley Cr.	NW ¼, SW ¼, Sec. 7, T24N, R19E
Not Named	SW ¼, SW ¼, Sec. 5, T24N, R19E
Not Named	NW ¼, NW ¼, Sec. 18, T24N, R19E
Not Named	SW ¼, NW ¼, Sec. 18, T24N, R19E
Santana/Higgins Springs	NE ¼, SE ¼, Sec. 13, T24N, R18E
Not Named	SE ¼, SE ¼, Sec. 13, T24N, R18E
Not Named	SE ¼, SE ¼, Sec. 13, T24N, R18E
South Fork, Dry Valley Cr. - Fork	NE ¼, NE ¼, Sec. 24, T24N, R18E
South Fork, Dry Valley Cr. - Fork	SE ¼, NE ¼, Sec. 24, T24N, R18E
South Fork, Dry Valley Cr. - Fork	SW ¼, SW ¼, Sec. 19, T24N, R19E
South Fork, Dry Valley Cr.	SW ¼, SW ¼, Sec. 19, T24N, R19E
South Fork, Dry Valley Cr. - Fork	NW ¼, NW ¼, Sec. 30, T24N, R19E
Not Named	SW ¼, NE ¼, Sec. 31, T24N, R19E

TABLE B-4

**DRAINAGE CROSSINGS ALONG PROPOSED WATER PIPELINE
ROUTE** (Pipeline descriptions are grouped into three segments:
(1) Fish Springs Ranch; (2) Fish Springs Ranch to Hungry Valley; and
(3) Hungry Valley to Lemmon Valley)

Drainage Name	Crossing Location
Segment 2: Fish Springs Ranch - Hungry Valley (Continued)	
Not Named	NW ¼, SE ¼, Sec. 31, T24N, R19E
Not Named	SW ¼, SE ¼, Sec. 31, T24N, R19E
Not Named	NW ¼, SE ¼, Sec. 8, T23N, R19E
Not Named	NW ¼, SW ¼, Sec. 9, T23N, R19E
Not Named	NE ¼, SW ¼, Sec. 9, T23N, R19E
Not Named	NE ¼, NE ¼, Sec. 16, T23N, R19E
Not Named	SW ¼, NW ¼, Sec. 15, T23N, R19E
Not Named	SW ¼, SW ¼, Sec. 15, T23N, R19E
Not Named	NW ¼, NW ¼, Sec. 22, T23N, R19E
Not Named	SE ¼, SE ¼, Sec. 22, T23N, R19E
Not Named	SE ¼, SW ¼, Sec. 22, T23N, R19E
Not Named	NW ¼, SE ¼, Sec. 27, T23N, R19E
Not Named	NW ¼, SE ¼, Sec. 27, T23N, R19E
Not Named	NE ¼, SE ¼, Sec. 27, T23N, R19E
Not Named	NW ¼, SE ¼, Sec. 26, T23N, R19E
Not Named	SW ¼, SW ¼, Sec. 25, T22N, R19E
Not Named	SW ¼, SW ¼, Sec. 1, T22N, R19E
Not Named	SE ¼, NW ¼, Sec. 12, T22N, R19E
Not Named	SE ¼, SE ¼, Sec. 12, T22N, R19E
Not Named	SW ¼, NW ¼, Sec. 18, T22N, R20E
Not Named	SE ¼, SW ¼, Sec. 18, T22N, R20E
Not Named	SW ¼, NE ¼, Sec. 20, T22N, R20E
Not Named	NW ¼, NW ¼, Sec. 21, T22N, R20E
Not Named	NW ¼, NW ¼, Sec. 21, T22N, R20E
Segment 3: Hungry Valley - Lemmon Valley	
Not Named	NW ¼, NE ¼, Sec. 21, T22N, R20E
Not Named	NE ¼, SE ¼, Sec. 21, T22N, R20E
Not Named	SW ¼, NW ¼, Sec. 27, T22N, R20E
Not Named	NW ¼, NW ¼, Sec. 27, T22N, R20E
Not Named	SE ¼, SE ¼, Sec. 28, T22N, R20E
Not Named	NW ¼, SE ¼, Sec. 33, T22N, R20E
Not Named	SE ¼, NW ¼, Sec. 33, T22N, R20E
Not Named	SW ¼, NW ¼, Sec. 8, T21N, R20E

TABLE B-5 SPRINGS WITHIN 1.0 MILE OF PROPOSED WATER PIPELINE ROUTE (½ mile to either side of pipeline)		
Springs Map No.^(a)	Location	Distance From Pipeline (ft)
43	SW ¼, SW ¼, Sec 2, T25N, R18E	≈ 800 - 900
44	SW ¼, SW ¼, Sec 2, T25N, R18E	≈ 800 - 900
51	SE ¼, SE ¼, Sec 2, T25N, R18E	≈ 100 - 200
52	SE ¼, SW ¼, Sec 11, T25N, R18E	≈ 300
53	SE ¼, NE ¼, Sec 15, T25N, R18E	≈ 1,200
54	SE ¼, NW ¼, Sec 23, T25N, R18E	≈ 900
102	SW ¼, NE ¼, Sec 19, T24N, R19E	≈ 500
142	NW ¼, SW ¼, Sec 31, T24N, R19E	≈ 2,600
^(a) Map numbers correlate with numbers in Table B-3, from JBR (1990c)		

TABLE B-6	
DRAINAGE CROSSINGS ALONG PROPOSED GAS PIPELINE ROUTE (Does not include crossings where this route is contiguous with the route of the water pipeline; see Table B-4)	
Drainage Name	Crossing Location
Not Named	NE ¼, NE ¼, Sec. 21, T22N, R20E
Not Named	NE ¼, NE ¼, Sec. 21, T22N, R20E
Not Named	NE ¼, NE ¼, Sec. 22, T22N, R20E
Not Named	SE ¼, NE ¼, Sec. 15, T22N, R20E
Not Named	NW ¼, SE ¼, Sec. 14, T22N, R20E
Not Named	NE ¼, SE ¼, Sec. 14, T22N, R20E
Not Named	NW ¼, SE ¼, Sec. 13, T22N, R20E
Not Named	NE ¼, SW ¼, Sec. 13, T22N, R20E
Not Named	NW ¼, NE ¼, Sec. 13, T22N, R20E
Not Named	NE ¼, SW ¼, Sec. 8, T22N, R21E
Not Named	SW ¼, NE ¼, Sec. 21, T22N, R21E
Not Named	SE ¼, NE ¼, Sec. 21, T22N, R21E
Not Named	NE ¼, SE ¼, Sec. 27, T22N, R21E
Not Named	NE ¼, SW ¼, Sec. 26, T22N, R21E
Not Named	SW ¼, SE ¼, Sec. 26, T22N, R21E
Not Named	SW ¼, NW ¼, Sec. 36, T22N, R21E
Not Named	SE ¼, SW ¼, Sec. 36, T22N, R21E
Not Named	SE ¼, SE ¼, Sec. 1, T21N, R21E
Not Named	NW ¼, NW ¼, Sec. 17, T21N, R22E
Not Named	SE ¼, SE ¼, Sec. 17, T21N, R22E
Not Named	NE ¼, SW ¼, Sec. 21, T21N, R22E
Not Named	SW ¼, SW ¼, Sec. 22, T21N, R22E
Not Named	NW ¼, NW ¼, Sec. 33, T21N, R23E
Not Named	NW ¼, NE ¼, Sec. 34, T21N, R23E

TABLE B-7		
SPRINGS WITHIN 1.0 MILE OF PROPOSED GAS PIPELINE ROUTE (½ mile to either side of pipeline; does not include springs where this route is contiguous with the route of the water pipeline; see Table B-5)		
Spring Name	Location	Distance from Pipeline (ft)
Butler	T22N, R20E	≈ 700
Coyote	SE ¼, SE ¼, Sec. 12, T22N, R20E	≈ 1,100
Not Named	W ¼, NW ¼, Sec. 28, T21N, R22E	≈ 1,500
Sheehan	W ¼, NW ¼, Sec. 30, T21N, R23E	≈ 1,500

TABLE B-8
DRAINAGE CROSSINGS ALONG WINNEMUCCA
VALLEY ALTERNATIVE WATER PIPELINE ROUTE
(Does not include crossings where this route is contiguous
with the route of the proposed water pipeline; see Table B-4)

Drainage Name	Crossing Location
Not Named	SE ¼, SW ¼, Sec. 11, T25N, R18E
Not Named	SE ¼, SW ¼, Sec. 11, T25N, R18E
Not Named	NE ¼, NE ¼, Sec. 14, T25N, R18E
Not Named	NE ¼, SW ¼, Sec. 13, T25N, R18E
Not Named	SE ¼, SE ¼, Sec. 13, T25N, R18E
Not Named	SW ¼, SW ¼, Sec. 18, T25N, R19E
Not Named	NE ¼, NW ¼, Sec. 19, T25N, R19E
Not Named	NW ¼, NE ¼, Sec. 19, T25N, R19E
Not Named	NE ¼, NE ¼, Sec. 19, T25N, R19E
Not Named	SW ¼, NW ¼, Sec. 20, T25N, R19E
Not Named	NE ¼, SW ¼, Sec. 20, T25N, R19E
Not Named	SE ¼, NE ¼, Sec. 33, T25N, R19E
Not Named	SW ¼, SW ¼, Sec. 34, T25N, R19E
Dry Valley Creek	SE ¼, SE ¼, Sec. 3, T24N, R19E
Not Named	SW ¼, SE ¼, Sec. 11, T24N, R19E
Not Named	SW ¼, NW ¼, Sec. 13, T24N, R19E
Not Named	NW ¼, SW ¼, Sec. 13, T24N, R19E
Not Named	SW ¼, SE ¼, Sec. 13, T24N, R19E
Not Named	NW ¼, SW ¼, Sec. 19, T24N, R20E
Not Named	NW ¼, SW ¼, Sec. 19, T24N, R20E
Not Named	SW ¼, SW ¼, Sec. 19, T24N, R20E
Not Named	NE ¼, NE ¼, Sec. 30, T24N, R20E
Not Named	NW ¼, SW ¼, Sec. 29, T24N, R20E
Not Named	NE ¼, NE ¼, Sec. 32, T24N, R20E
Not Named	NE ¼, SW ¼, Sec. 33, T24N, R20E
Not Named	NW ¼, NE ¼, Sec. 4, T23N, R20E
Not Named	SE ¼, NE ¼, Sec. 4, T23N, R20E
Not Named	SW ¼, SW ¼, Sec. 3, T23N, R20E
Not Named	NW ¼, SW ¼, Sec. 10, T23N, R20E
Not Named	SE ¼, NW ¼, Sec. 15, T23N, R20E
Not Named	SE ¼, NE ¼, Sec. 27, T23N, R20E
Not Named	NE ¼, SE ¼, Sec. 34, T23N, R20E
Not Named	SE ¼, NE ¼, Sec. 3, T22N, R20E
Not Named	NE ¼, NE ¼, Sec. 10, T22N, R20E
Not Named	NE ¼, NE ¼, Sec. 21, T22N, R20E
Not Named	NE ¼, NE ¼, Sec. 21, T22N, R20E
Not Named	NE ¼, NE ¼, Sec. 22, T22N, R20E
Not Named	SE ¼, NE ¼, Sec. 15, T22N, R20E

TABLE B-9

**SPRINGS WITHIN 1.0 MILE OF WINNEMUCCA
VALLEY ALTERNATIVE WATER PIPELINE ROUTE**

(½ mile to either side of pipeline; does not include springs where this route is
contiguous with the route of the proposed water pipeline, see Table B-5)

Springs Map No. ^(a)	Location	Distance from Pipeline (ft)
51	SE ¼, SE ¼, Sec 10, T25N, R18E	≈ 500
52	SW ¼, SW ¼, Sec 11, T25N, R18E	≈ 600
Not Named	NW ¼, Sec 19, T25N, R18E	≈ 900
64	SW ¼, SE ¼, Sec 20, T25N, R19E	> 100
72	SE ¼, NW ¼, Sec 34, T25N, R19E	≈ 2300
73	SW ¼, NW ¼, Sec 34, T25N, R19E	≈ 1200
74	NW ¼, SE ¼, Sec 34, T25N, R19E	≈ 2200
75	NE ¼, SW ¼, Sec 34, T25N, R19E	≈ 1800
110	NW ¼, NW ¼, Sec 2, T25N, R19E	≈ 2200
111	NW ¼, NW ¼, Sec 2, T25N, R19E	≈ 2300
112	NW ¼, NW ¼, Sec 2, T25N, R19E	≈ 2400
113	NW ¼, NW ¼, Sec 2, T25N, R19E	≈ 1700
114	NE ¼, NE ¼, Sec 3, T24N, R19E	≈ 2300
115	NW ¼, NW ¼, Sec 2, T25N, R19E	≈ 2300
116	SW ¼, SW ¼, Sec 3, T24N, R19E	≈ 700
Not Named	SW ¼, NW ¼, Sec 19, T24N, R20E	≈ 200
Not Named	SE ¼, SE ¼, Sec 24, T24N, R19E	≈ 2000
Not Named	SE ¼, SE ¼, Sec 19, T24N, R20E	≈ 1200
Not Named	NE ¼, SW ¼, Sec 33, T24N, R20E	≈ 500
Not Named	SE ¼, NE ¼, Sec 22, T23N, R20E	≈ 300
Not Named	NE ¼, SE ¼, Sec 22, T23N, R20E	≈ 800
Not Named	NW ¼, SW ¼, Sec 23, T23N, R20E	≈ 1800
Willow	SW ¼, SE ¼, Sec 3, T23N, R20E	≈ 1700
Butler	SE ¼, SW ¼, Sec 14, T22N, R20E	≈ 1600

^(a) Map numbers correlate with numbers in Table B-3, from JBR (1990c).

TABLE B-10

**DRAINAGE CROSSINGS ALONG ANTELOPE VALLEY
ALTERNATIVE WATER PIPELINE ROUTE**
(Does not include crossings where this route is contiguous
with the route of the proposed water pipeline; see Table B-4)

Drainage Name	Crossing Location
Not Named	NW ¼, SE ¼, Sec. 11, T22N, R19E
Not Named	SW ¼, SE ¼, Sec. 11, T22N, R19E
Not Named	SE ¼, SW ¼, Sec. 11, T22N, R19E
Not Named	SW ¼, NW ¼, Sec. 14, T22N, R19E
Not Named	NW ¼, SW ¼, Sec. 14, T22N, R19E
Not Named	NE ¼, SE ¼, Sec. 15, T22N, R19E
Not Named	NW ¼, SW ¼, Sec. 23, T22N, R19E
Not Named	NE ¼, SE ¼, Sec. 22, T22N, R19E
Not Named	NE ¼, SE ¼, Sec. 3, T21N, R19E

TABLE B-11

**DRAINAGE CROSSINGS ALONG RED ROCK VALLEY
ALTERNATIVE WATER PIPELINE ROUTE**
(Does not include crossings where this route is contiguous
with the route of the proposed water pipeline; see Table B-4)

Drainage Name	Crossing Location
Not Named	NE ¼, NE ¼, Sec. 36, T24N, R18E
Not Named	NE ¼, SW ¼, Sec. 36, T24N, R18E
Not Named	NE ¼, NE ¼, Sec. 11, T23N, R18E
Not Named	NE ¼, NE ¼, Sec. 14, T23N, R18E
Not Named	NW ¼, SE ¼, Sec. 14, T23N, R18E
Not Named	NW ¼, SE ¼, Sec. 14, T23N, R18E
Not Named	NW ¼, NW ¼, Sec. 24, T23N, R18E
Not Named	NW ¼, NW ¼, Sec. 24, T23N, R18E
Not Named	SE ¼, NW ¼, Sec. 35, T23N, R18E
Not Named	SE ¼, NW ¼, Sec. 35, T23N, R18E
Not Named	SW ¼, NE ¼, Sec. 2, T22N, R18E
Not Named	SW ¼, NW ¼, Sec. 1, T22N, R18E
Not Named	SW ¼, SW ¼, Sec. 6, T22N, R19E
Not Named	SE ¼, SW ¼, Sec. 7, T22N, R19E
Not Named	NW ¼, SE ¼, Sec. 18, T22N, R19E
Not Named	SE ¼, NE ¼, Sec. 19, T22N, R19E
Not Named	SE ¼, SE ¼, Sec. 19, T22N, R19E
Not Named	NE ¼, SW ¼, Sec. 5, T21N, R19E

TABLE B-12		
SPRINGS WITHIN 1.0 MILE OF RED ROCK VALLEY ALTERNATIVE WATER PIPELINE ROUTE (Does not include springs where this route is contiguous with the route of the proposed water pipeline; see Table B-5)		
Spring Name	Location	Distance from Pipeline (ft)
Not Named	NW ¼, SW ¼, Sec. 12, T23N, R18E	≈ 2000
Not Named	NW ¼, NW ¼, Sec. 24, T23N, R18E	≈ 200
Not Named	NW ¼, NW ¼, Sec. 24, T23N, R18E	≈ 200
Not Named	NW ¼, SE ¼, Sec. 24, T23N, R18E	≈ 200
Not Named	SE ¼, NW ¼, Sec. 35, T23N, R18E	≈ 100
Not Named	NW ¼, SW ¼, Sec. 35, T23N, R18E	≈ 200
Juniper	NW ¼, SW ¼, Sec. 6, T22N, R19E	≈ 500
Juniper	NE ¼, SW ¼, Sec. 6, T22N, R19E	≈ 900

TABLE B-13		
DISCHARGE REQUIREMENTS FOR THE TRUCKEE MEADOWS WATER RECLAMATION FACILITY ^(a)		
Water Quality Parameters	Discharge Limitation	
	30-Day Average	Daily Maximum
Flow, mgd	40	---
BOD mg/l ^(b)	20	30
Suspended Solids, mg/l	20	30
Total Nitrogen, mg/l	5	--
Nitrates, mg/l	--	2
Ammonia (N), (May-Oct), mg/l	2.6	--
Ammonia (N), (Nov-Apr), mg/l	5.3	--
Un-ionized Ammonia (N), mg/l	--	0.2
Phosphates (total P), mg/l	0.4 ^(c)	--
Total Dissolved Solids (TDS), mg/l	360	--
Temperature Change	--	Not >2°C
Fecal Coliform Bacteria, count/100 ml	200	400
Dissolved Oxygen mg/l	^(d)	^(d)
pH	^(e)	^(e)
^(a) Capacity of 40 million gallons/day (mgd) ^(b) BOD - Biological oxygen demand, mg/l ^(c) Based on flow of 40 mgd. Mass limitation at or above flow of 27 mgd is 134 pounds per day. ^(d) Not <5.0 mg/l at any time ^(e) Not <6.5 or >8.5 at any time. Source: Gonzales, 1991-1992.		

TABLE B-14

**DISCHARGE REQUIREMENTS FOR THE RENO-STEAD WASTEWATER TREATMENT PLANT
AND THE LEMMON VALLEY WASTEWATER TREATMENT PLANT (WWTP)^(a)**

	Discharge Limitations	
	30-Day Average	Daily Maximum
Flow ^(b)	---	1.5 mgd Reno-Stead WWTP ^(c) 0.3 mgd Lemmon Valley WWTP ^(c)
BOD ^(d)	30	45
Suspended solids, mg/l	30	45
Fecal coliform bacteria, count/100ml	200	400
pH	(e)	(e)
(a) Secondary treatment only; no disinfectant capability. Both plants are in Lemmon Valley. (b) Discharge held in ponds for evaporation. (c) mgd = Million gallons per day. (d) BOD - Biological oxygen demand, mg/l. (e) Not less than 6.0; not greater than 9.0. Source: Smith, 1992; Molin, 1992		

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2.0 Objectives

3.0 Study Area

4.0 Methodology

5.0 Results

APPENDIX C

GROUNDWATER HYDROLOGY

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1.0 Introduction

The following report describes the work performed to evaluate the potential environmental impacts to groundwater associated with withdrawing 13,000 acre-feet per year (acre-ft/yr) from the eastern section of Honey Lake Valley at Fish Springs Ranch (FSR). Honey Lake Valley is located 35 miles northwest of Reno, Nevada, and 10 miles southeast of Susanville, California. A request for increasing the pumping at FSR, located in the extreme southeast portion of Honey Lake Valley, has been approved by the State Engineer of Nevada (as amended). The present pumping rate at FSR is 5,910 acre-ft/yr. Approval to increase the pumping to 13,000 acre-ft/yr has been given under the conditions described in the main Environmental Impact Statement (EIS). An environmental impact analysis is required to evaluate the potential impact of withdrawing the additional groundwater. The potential environmental impacts have been identified as impacts to groundwater quantity and quality primarily to eastern Honey Lake Valley and secondarily to adjacent groundwater basins in the Smoke Creek Desert and Pyramid Lake Basin. Potential environmental impacts to the basins that will receive the pumped groundwater, Spanish Springs and Lemmon Valley, will be addressed as well. As the primary area of concern is Honey Lake Valley and adjacent basins due to the greater potential for environmental impacts in these areas, the following report will focus on Honey Lake Valley, Smoke Creek Desert and Pyramid Lake Basin. Environmental impacts related to groundwater in Spanish Springs and Lemmon Valley are addressed in the main EIS text.

Upon request from the U.S. Bureau of Land Management, several databases and spreadsheets can be made available to the reader. These include a list of all wells in and near Honey Lake Valley used to construct the models described herein, as well as data on water levels and water quality in these wells. In addition, two large maps are available. One shows the location of all the wells used to construct the models. The second, from which Figure 10 was prepared, shows the 1988 TDS distribution throughout the area.

2.0 Approach

A data review was performed as part of the environmental analysis to determine the amount of information available related to groundwater conditions in Honey Lake Valley. Based on this review it was determined that the USGS computer model of eastern Honey Lake Valley, with some modification, could be used to characterize groundwater flow conditions and potential environmental impacts in Honey Lake Valley. The modification required was to incorporate Sierra Army Depot (SIAD) pumpage into the existing USGS flow model of Honey Lake Valley, as discussed in Section 5.0. To evaluate water quality impacts from proposed pumping, a water quality computer model is required. The data-review results indicated a regional water quality model encompassing the entire eastern Honey Lake Valley was not available. As part of the EIS, a regional water quality computer model was constructed and the water quality impacts from pumping 13,000 acre-ft/yr evaluated. The following potential environmental impacts have been identified for evaluation.

2.1 Impacts Related to Lowering Groundwater Levels

As a result of withdrawing groundwater in Honey Lake Valley, groundwater levels will be lowered below their present levels. The potential direct impacts to water resources from groundwater level lowering may include:

Well User Impact - The main potential impacts to well users would be limited access to water supply due to increased depth to water requiring drilling of deeper wells and/or increased pumping lift costs.

Subsidence - Land subsidence may occur in areas where groundwater lowering is extreme, most likely near pumping centers. Environmental impacts from land subsidence may consist of land-surface settling, cracking and slumping, which could result in damage to any existing structures and limitation of future use of the affected land. In addition, subsidence in the saturated zone has a potential irreversible compaction effect, which could result in a decrease of future aquifer storage potential.

Basin Outflow - Withdrawal of groundwater in Honey Lake Valley may cause the present outflow rates from Honey Lake basin to decrease, thereby decreasing recharge to adjacent basins. Indirect impacts from lowering water levels may be decreased evapotranspiration from lowering groundwater below phreatophyte root depths and reductions in spring flow. Both these indirect impacts are discussed in detail in the surface water and vegetation sections of the main EIS report.

2.2 Impacts Related to Water Quality

Water quality may be affected through well pumpage by inducing migration of poorer quality water to flow toward areas of historically good water quality. The potential areas of water quality impact are:

Groundwater Quality in Honey Lake Valley - Migration of poorer quality water due to pumpage may adversely impact existing well users by degrading their existing water quality and by reducing access to good quality water to future groundwater users.

Groundwater Quality in Adjacent Basins - Water quality degradation could occur from limiting outflow of good quality water to adjacent basins or causing degradation of the quality of groundwater that flows to adjacent basins.

The following sections describe the data review, data evaluation, models used to analyze flow and water quality impacts, and impact analyses.

3.0 Data Review

A data review was performed to obtain all information on Honey Lake Valley groundwater flow and water quality. The data review consisted of an extensive literature search,

contacting and obtaining information from agencies and knowledgeable individuals, and the review of hearing transcripts from the 1990 Honey Lake groundwater hearings, as described below. Information obtained from these sources was used to develop comprehensive databases on groundwater in Honey Lake Valley.

3.1 Literature Review

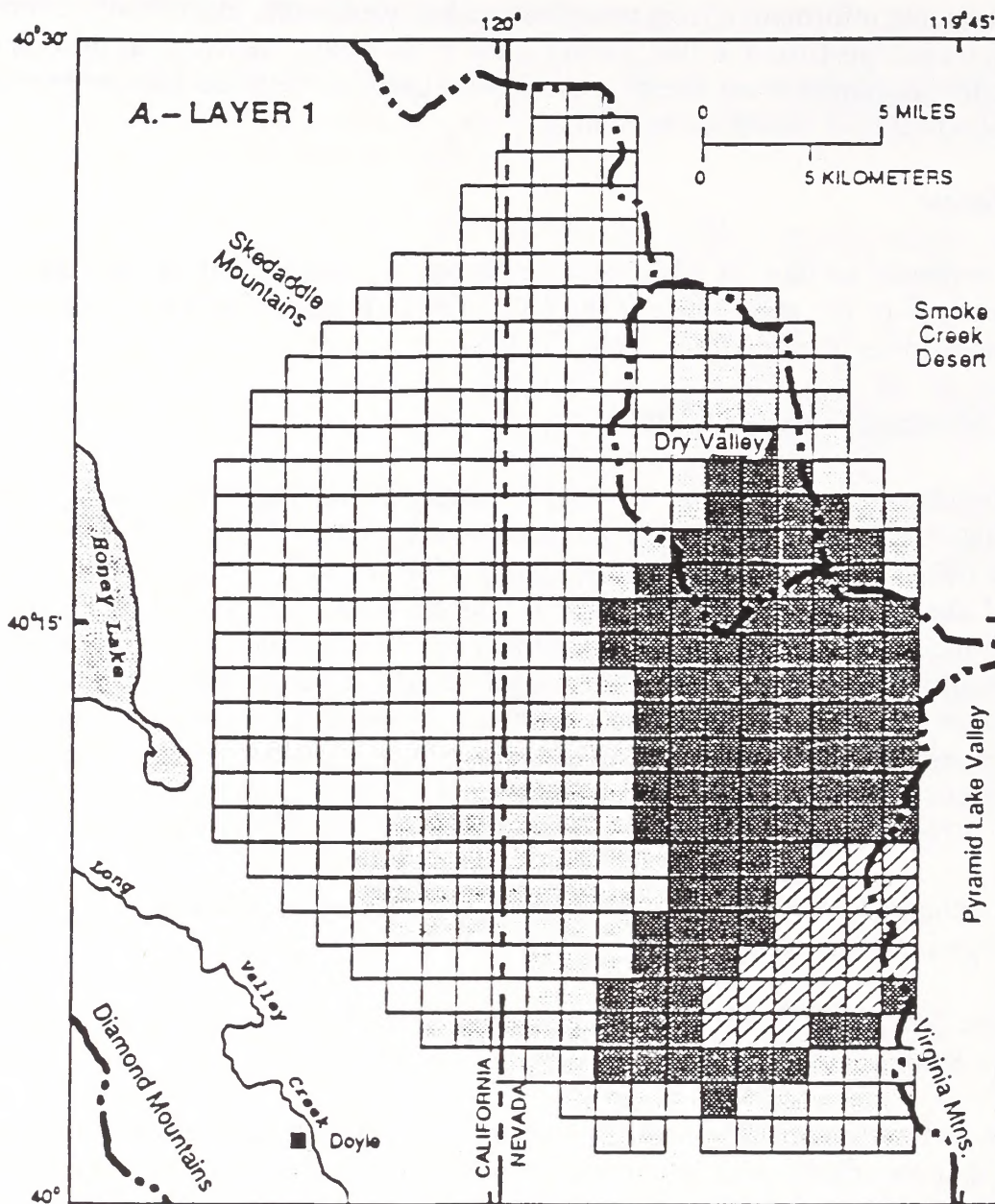
The documents reviewed as part of the literature search are referenced in the text and contained in Chapter 7 of the main body of the EIS. The following is a brief summary of the Water Resource Investigations Report No. 90-4050.

Water Resources Investigation Report 90-4050

The most comprehensive investigation of eastern Honey Lake Valley is USGS Water Resources Investigation Report 90-4050 (Handman et al., 1990). This report, hereafter referred to as the *USGS report*, summarized the work performed by the USGS to model the eastern Honey Lake Valley area. To perform this analysis, the MODFLOW finite difference flow model was used to simulate the effect of pumping 15,000 acre-ft/yr at FSR. The drawdown resulting from the projected future pumping was compared to groundwater surface elevations in 1988, and a map of the expected increase in drawdown, compared to 1988 groundwater levels, was generated. Groundwater conditions in 1988 were assumed to represent steady state conditions. The analysis of future pumping was performed as a steady state simulation. The results of the modeling analysis indicated the following:

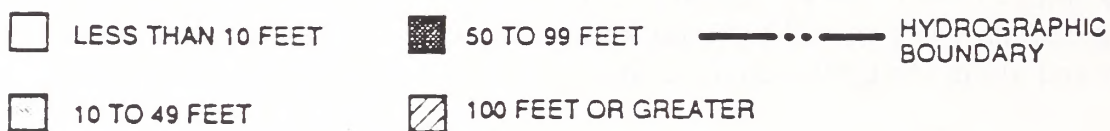
1. Additional recharge of 5,000 acre-ft/yr may be flowing into the valley through the southern Virginia Mountains.
2. Subsurface outflow may occur through Astor Pass to Pyramid Lake Basin and through Sand Pass to Smoke Creek Desert.
3. Limited flow in the range of 580 acre-ft/yr occurs from Honey Lake eastward toward FSR in the shallow aquifer and 590 acre-ft/yr flows from eastern Honey Lake Valley westward toward Honey Lake in the deeper aquifer.
4. The USGS model indicates the greatest drawdown areas are near the pumping wells at FSR with drawdowns over 100 feet, and drawdown predicted to occur along the eastern boundary to Pyramid Lake Basin, the northeastern boundary to Smoke Creek Desert and along the California state line.

Figures 1.0 a-d and Table 1.0 are excerpted from the USGS report and present the estimated drawdown from the model and the impact to hydrologic inflows and outflows in the valley from the increased pumping. It should be noted that the USGS model was not designed to simulate groundwater conditions at the SIAD located at the western edge of the USGS flow model. Section 5.0 discusses the SIAD in more detail. For a detailed discussion of the hydrologic and geologic assumptions used in developing the USGS model, Water Resources Publication No. 90-4050 should be reviewed.



EXPLANATION

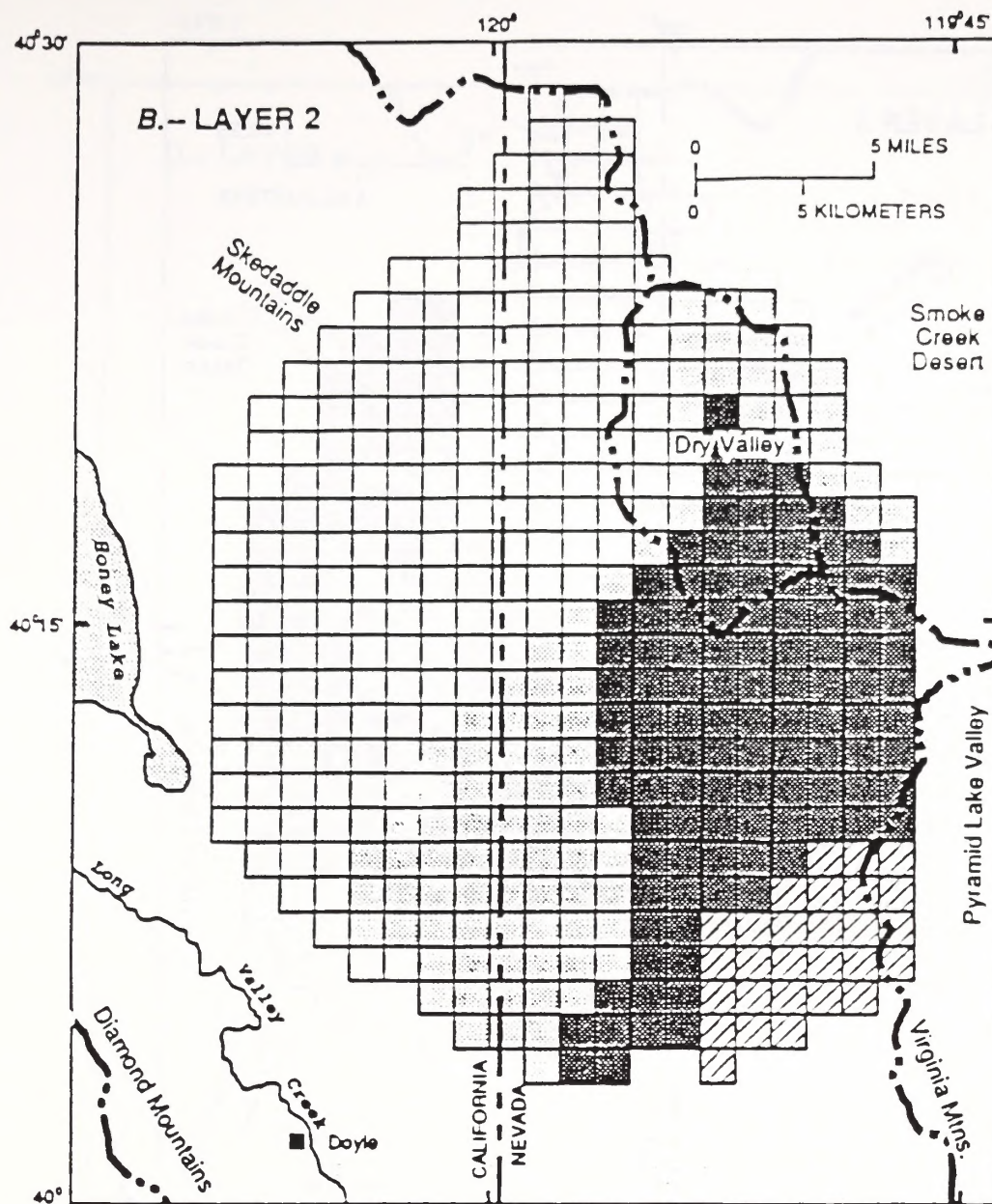
WATER-LEVEL DRAWDOWN IN MODEL CELL



REFERENCE: WATER RESOURCES INVESTIGATIONS REPORT 90-4050

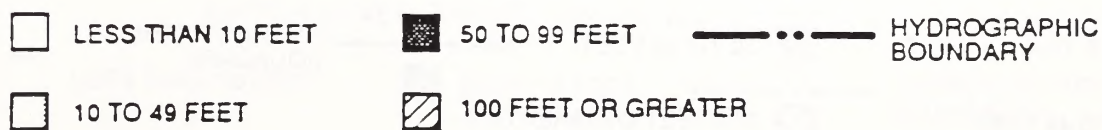
FIGURE 1.0a

SIMULATED WATER LEVEL DRAWDOWN FROM PUMPING 15,000 AF/YR
AT FISH SPRINGS RANCH LAYER 1, USGS MODEL.



EXPLANATION

WATER-LEVEL DRAWDOWN IN MODEL CELL

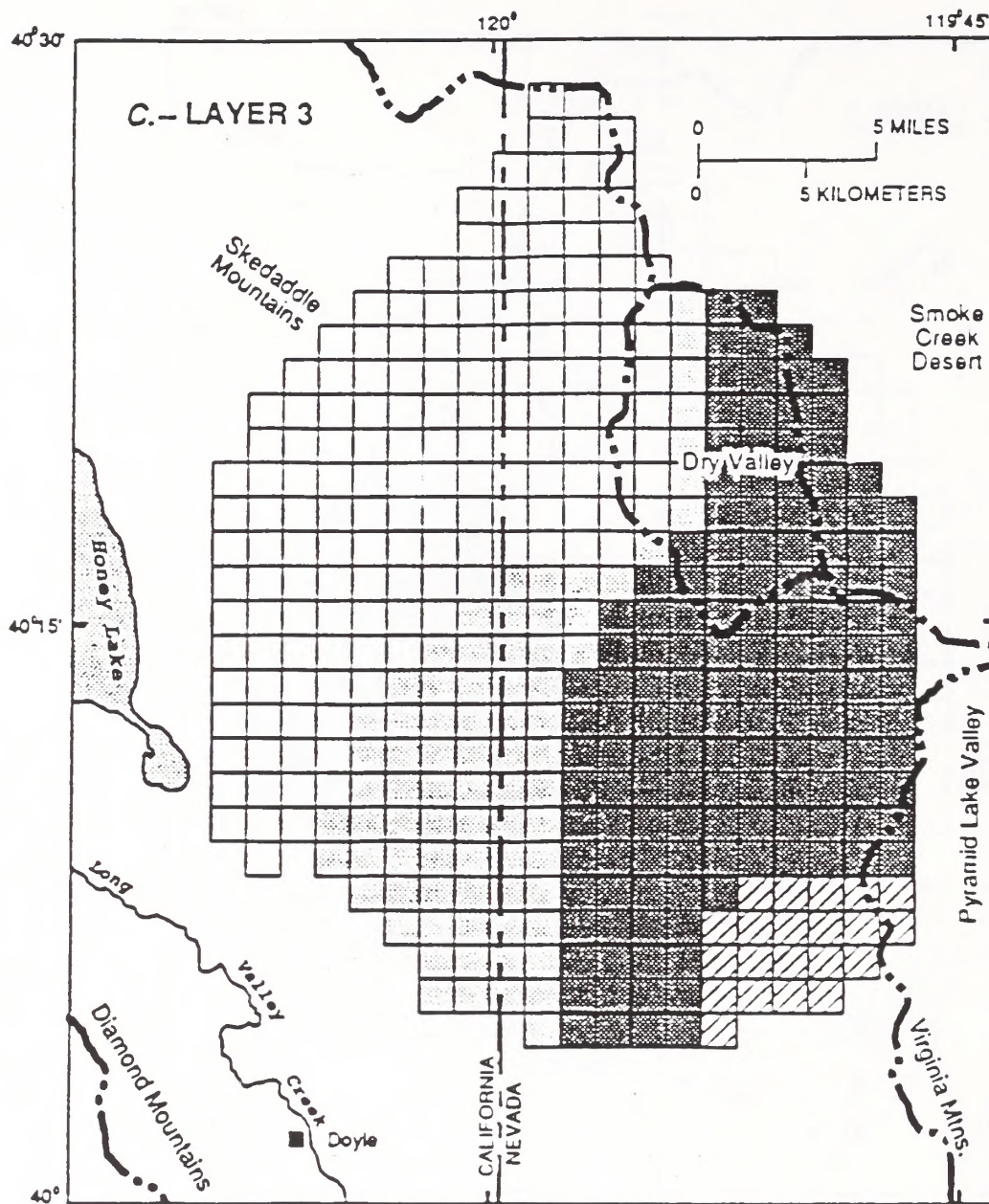


REFERENCE: WATER RESOURCES INVESTIGATIONS REPORT 90-4050

FIGURE 1.0b

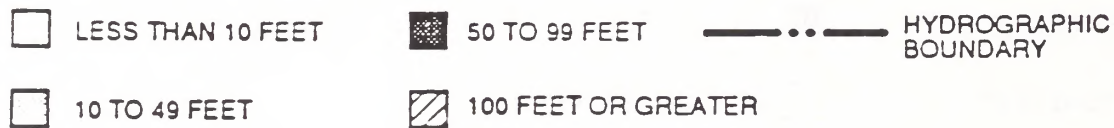
SIMULATED WATER LEVEL DRAWDOWN FROM PUMPING 15,000 AF/YR

AT FISH SPRINGS RANCH, LAYER 2. USGS MODEL.



EXPLANATION

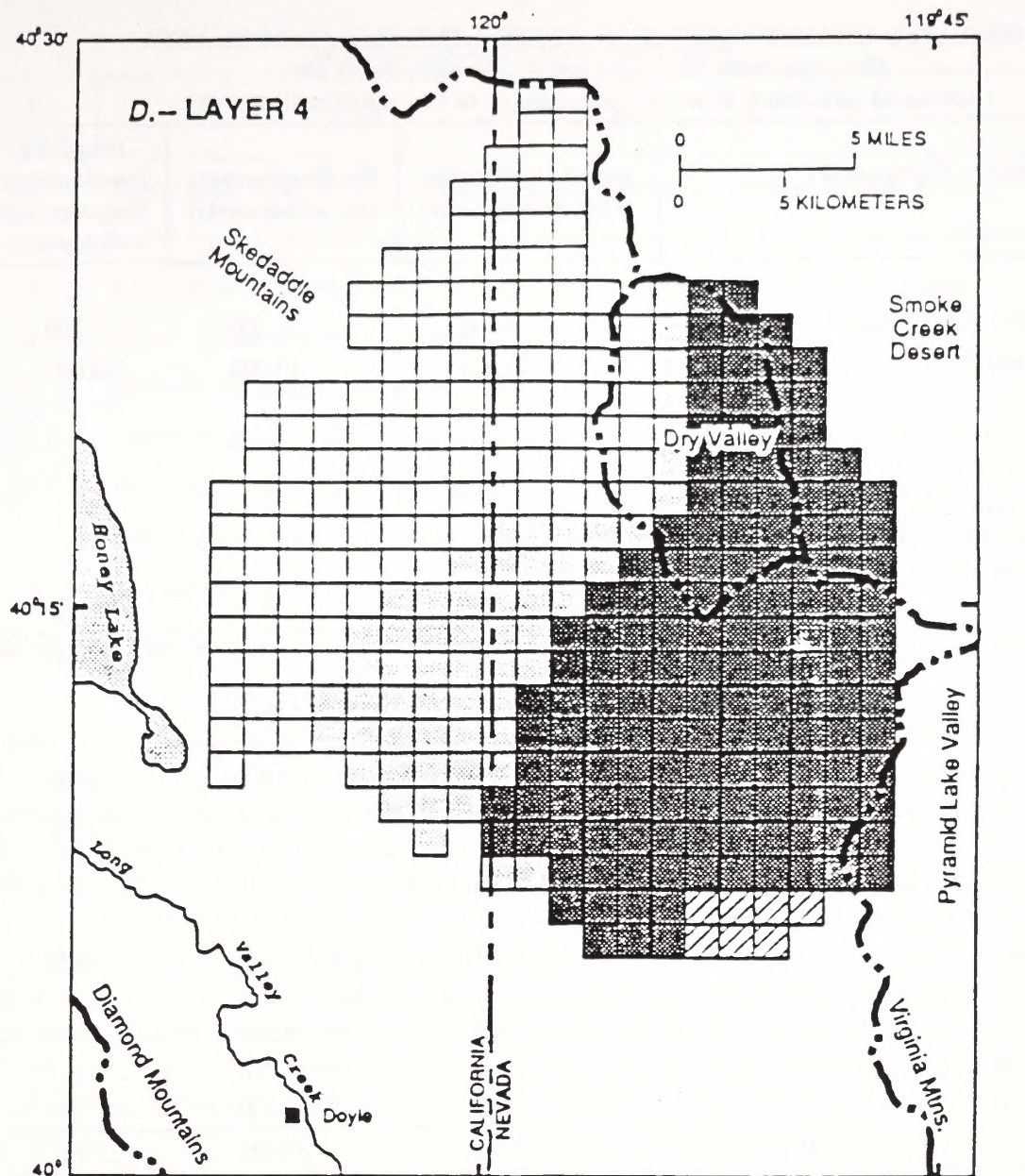
WATER-LEVEL DRAWDOWN IN MODEL CELL



REFERENCE: WATER RESOURCES INVESTIGATIONS REPORT 90-4050

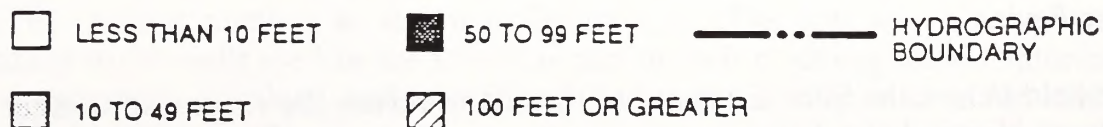
FIGURE 1.0c

SIMULATED WATER LEVEL DRAWDOWN FROM PUMPING 15,000 AF/YR
AT FISH SPRINGS RANCH, LAYER 3, USGS MODEL.



EXPLANATION

WATER-LEVEL DRAWDOWN IN MODEL CELL



REFERENCE: WATER RESOURCES INVESTIGATIONS REPORT 90-4050

FIGURE 1.0d

SIMULATED WATER LEVEL DRAWDOWN FROM PUMPING 15,000 AF/YR
AT FISH SPRINGS RANCH, LAYER 4, USGS MODEL.

TABLE 1.0

SIMULATED GROUNDWATER BUDGETS FOR THE FLOW MODEL AREA
 (Excerpts from USGS Report No. 90-4050, Table 19)
 (Estimated quantities, in acre-ft/yr, rounded to two significant figures)

Budget Component	Model Calibration (1988 withdrawals)	Pre-Development (no withdrawals)	Proposed Development (hypothetical withdrawals)
RECHARGE:			
Direct infiltration of precipitation ^(a)	9,200	9,200	9,200
Infiltration of runoff	13,000	13,000	13,000
Irrigation return:			
- from surface-water irrigation	0	0	0
- from groundwater irrigation	1,500	0	0
Groundwater inflow to model area from Honey Lake area and Long Valley Creek area (in shallow layers of model)	580	570	660
Total Recharge	24,000	23,000	23,000
DISCHARGE:			
Groundwater evapotranspiration	11,000	15,000	4,600
Withdrawals from wells (Number of simulated wells)	5,900 (5)	0 (0)	15,000 (18)
Groundwater outflow from model area westward to Honey Lake area (in deeper layers of model)	590	610	420
Groundwater outflow eastward to Smoke Creek Desert	5,300	5,500	2,000
Groundwater outflow eastward to Pyramid Lake Valley	1,500	1,500	700
Total Discharge	24,000	23,000	23,000

^(a) Includes 5,000 acre-ft/yr that may originate outside the southeast boundary of the basin.

3.2 Transcripts Review

Hearings were held before the State Engineer of Nevada to review the request to transfer groundwater from Honey Lake Valley to the northern valleys near Reno. During the hearings, information on Honey Lake Valley groundwater conditions was submitted by Washoe County. This information consisted of aquifer tests and water quality data generated during and after the preparation and completion of the USGS model study. The hearing transcripts were reviewed and applicable information incorporated into the present analysis. Table 2.0 lists the exhibits considered relevant to the environmental analysis.

TABLE 2.0	
1990 WATER HEARINGS EXHIBITS	
Exhibit Number	Description
19	Letter from Alan Mayo to Tony Rossmann regarding review of Report 90-4050
20	Letter from James Slosson to Tony Rossmann regarding review of Report 90-4050
32	Letter from Alan Mayo to Tony Rossmann regarding review of water quality
34	Water quality data printout with balance errors
52	Nork model steady state water levels
53	Washoe County drawdown data for Sand and Astor Pass
59	Nork/Bohm information package containing aquifer test data sheets and well logs
73	Information package containing water quality data collected by Washoe County
124	Isotopic data summary submitted by Lassen County

3.3 *Information Obtained from Agencies and Other Entities*

Additional information was obtained from the California Department of Water Resources (DWR), SIAD and the USGS. California DWR was contacted to obtain water level and water quality data on file from the ongoing water monitoring program performed by DWR on the California side of Honey Lake Valley. The SIAD provided information on the water supply system used by the Depot as well as preliminary information on groundwater contaminant plumes at the Depot, which are presently under investigation. The USGS was contacted to obtain any additional information on Honey Lake Valley groundwater conditions generated after completion of the USGS study. All additional information reviewed was incorporated into the database. Information in the database is current up to March 1992.

A total of 166 wells are located within Honey Lake Valley and the Smoke Creek Desert according to the data reviewed. Figure 2.0 shows the location of these wells (a larger map showing well locations is available from the BLM). Wells are identified with a unique WESTEC project number as shown in Figure 2.0. The first 40 wells are numbered identically to the wells used by the USGS as part of their modeling effort. Information on well construction, lithology, and water level and water quality records for each well is available from the BLM.

4.0 *Data Evaluation*

To provide the most up-to-date analysis of environmental impacts that may occur as a result of planned pumping, it was determined that data generated after the preparation of the

USGS report should be examined to determine if modifications to the USGS model would be needed to simulate groundwater conditions in the valley. The most recent data have been generated by Washoe County. The county has gathered data from numerous tests to characterize aquifer parameters and boundary conditions, from collection of water level data in key wells, and from water-quality sampling to further characterize water quality and flow conditions. Other information available since the USGS report was completed includes additional water level data collected by the California DWR and the USGS. Each data source is discussed in the following paragraphs.

4.1 Washoe County Data

Aquifer Test Data

Information on 17 aquifer tests was submitted to the State Engineer by Washoe County during the 1991 water hearings (Table 2.0, Exhibit #59). The aquifer tests were performed between 1985 and 1991. Of this total, nine aquifer tests generated data that could be analyzed to evaluate aquifer parameters. The results are summarized in Table 3.0 and include estimates of transmissivity, storativity and presence of boundary conditions. To augment the information from the tests, several new wells were installed by Washoe County in the valley. Newly installed wells are identified in Table 3.0 by an asterisk. These wells were located to obtain additional information on aquifer boundary conditions and to provide additional information on aquifer parameters. The locations where new wells were installed either as monitoring wells or test wells are FSR, Cottonwood Creek, Astor Pass and Sand Pass (Figure 2.0).

The aquifer test data included in Exhibit No. 59 were analyzed using the Jacob-Cooper Approximation method to the Theis solution. The Theis solution assumes an aquifer of infinite areal extent, radial flow, and homogeneous and isotropic flow conditions. Many of these assumptions will not be met by the aquifer system in Honey Lake Valley, as is the case with most natural systems requiring modeling with analytical solutions. The estimates provided using this method will provide a first-cut estimate of the aquifer parameters. Further analysis to consider such factors as fractured flow, leakage through confining beds, and partial well penetration may refine these estimates further but are not considered necessary to evaluate the regional aquifer system and flow model. The results indicate a wide range of transmissivity and storativity values depending on the location of the test area. As shown in Table 3.0, transmissivity values ranged from 13,200 GPD/FT (1,765 FT²/day) near the playa at well VES-8 (well #16) to an average of 371,666 GPD/FT (49,688 FT²/day) at the Jarboe well (well #17) for the 7-day test. Storativity values ranged from an average 3.2×10^{-1} at the Jarboe well (well #17) for the 7-day test to 4.7×10^{-5} at Astor Pass (well #128). Evaluation of the test data to characterize possible flow boundaries suggests there may be no flow boundaries in the vicinity of the Hodges well (well #24) and Jarboe well (well #17) to the east and south of FSR, respectively. Recharge boundaries may be present in the Sand Pass area. The Astor Pass test indicates there may be limited hydraulic communication between the Astor Pass test well (well #128) and Astor Pass MW #2 (well #51) within the upper 500 feet of the aquifer tested. The lack of water level

TABLE 3.0

WASHOE COUNTY AQUIFER TEST DATA

Test Well	WESTEC Well No.	Date/ Duration	Location	Well Radius (Ft.)	Pumping Rate (gpm)	Maximum Drawdown	Specific Capacity	Distance To Pumping Well	Screened Interval	Static H ₂ O Elev./Depth	Geology	T (gpd/n)	S	Boundary R = Recharge B = Barrier
Jarboe (24 Hr)		4/11/89	FSR											
Jarboe	17	24 Hrs		½ well 1.0/ ½ well 1.35	1800	110	16.4	- - -	95-492	3976.5/48.77	gravel to basalt	?		None
OB#1	121			0.16 ?		5.7		150	97-140	3977.4/52.01	andesite/ basalt	339,000	1.32 X 10 ⁻⁴	None
OB#2	122			0.10 ?		1.1		150	42-105	3978.1/48.55	sand and gravel	528,000	4.9 X 10 ⁻¹	None
Ferrel 1989 ^(a)			FSR											
Ferrel TW	110	3/29/89 to 4/8/89 10 Days		1.06	1375	137	10.0	- - -	36-246	3974.5/17.13	alluvium/ volcanics	?		None
OB#1	104			0.16 ?		11.6		150	63-252	3977.2/18.06	volcanics	80,600	1.6 X 10 ⁻²	None
OB#2	105			0.16 ?		3.5		1580	61-210	3973.4/24.65	med. sand & clayey sand	181,500	2.9 X 10 ⁻³	None
Hodges			FSR											
Hodges	24	4/22/89 to 5/2/89 10 Days		1.06	1900 to 2000	32	60.9	-	63-255	3973.7/36.73	"lava rock"	206,000		B
OB#1	117			0.16 ?		14		150	50-260	3973.4/37.84	gravel	224,000	1.6 X 10 ⁻⁴	B
OB#2	105			0.16 ?		6.9		700	42-126	3973.3/45.82	gravel	429,000 ?	3.4 X 10 ⁻³ ?	B
Sand Pass			Sand Pass											
TW ^(b)	91	4/5/90 to 4/7/90 3 Days		0.66	425	7.95	53.4	- - -	400-600	3948.9/158.4	basalt	85,700		R ?
MW-1 ^(b)	88			0.16		2.1		1205	560-740	3948.1/123.87	basalt	89,000	1.9 X 10 ⁻⁵	R
MW-2 ^(b)	89			0.16		3.7		1119	320-500	3949.1/122.79	basalt	101,000	1.5 X 10 ⁻⁴	R
Astor Pass			Astor Pass											
TW ^(b)	128	3/31/90 to 4/3/90 3 Days		0.66	450	42	10.7	- - -	270-450	3953.1/43.25	basalt	30,000	- - - -	
MW-1 ^(b)	50			0.16		7		1780	200-400	3954.1/43.30	basalt	47,500	4.7 X 10 ⁻⁵	
MW-2 ^(b)	51			0.16		0.8		855	270-490	3957.8/43.32	basalt		- - - -	B
Wilcon (1985)			FSR											

TABLE 3.0

WASIOE COUNTY AQUIFER TEST DATA

Test Well	WESTEC Well No.	Date/ Duration	Location	Well Radius (ft.)	Pumping Rate (gpm)	Maximum Drawdown	Specific Capacity	Distance To Pumping Well	Screened Interval	Static H ₂ O Elev./Depth	Geology	T (gpd/ft)	S	Boundary R = Recharge B = Barrier
Wilson	19	6/6/85 to 6/9/85 3 Days		1.33	3,000	84	36	---	160-440	3964.5/10.62		53,000	---	None
Eaton 1(c)						24.5		340	?	/6.50		69,000	4.7 X 10 ⁻³	None
Eaton 2						---				/10.85				None
Ford 1	106					---				/18.55				None
Ford 2	107					---				/14.39				None
Wilson (1989)			FSR											
Wilson	19			1.33	3,000	75.5	40		160? 440	3964.5/30.18		66,000		None
South (OW-2)	125	3/5/89 to 3/15/89 10 Days		.16 ?		18.5		500	62-230	3964.6/33.25	gravels	80,000	6.0 X 10 ⁻³	None
East (OW-1)	124			.16 ?		35.5		150	146-440	3965.2/28.53	sands	61,000	9.6 X 10 ⁻³	None
Head- quarters			FSR											
IIQ	20	3/17/89 to 3/24/89 7 Days		1.16	3100	12.4	248	---	60-100 open 100- 400	3976.8/36.38	volcanics	282,000	---	None
IIQ1	119					17.8		150	49-175	3977.4/34.77	sand/ gravel	182,000	7.7 X 10 ⁻³	None
IIQ2	120					5.0		150	211-400	3976.9/36.19	volcanics	481,000	3.5 X 10 ^{-2(d)}	None
Jarboe			FSR											
Jarboe (7 Days)	17	4/13/89 to 4/20/89 7 Days		1/2 Well 1.0' 1/2 Well 1.33'	1900	127.5	14.9		95-492	3976.5/49.21	gravel/ basalt	334,000		
OB#1	121			0.16 ?		9.4		150	97-140	3977.4/52.53	andesite /basalt	279,000	4.6 X 10 ⁻⁴	B
OB#2	122			0.16 ?		2.6		150	42-105	3978.1/49.07	sand/ gravel	502,000	6.5 X 10 ⁻¹	B
VES-8	16	1/23/85 13 Hrs	FSR	---	100	10.4	9.6	---		3968.7/188.5		13,200		R

(a) Unsatisfactory TW data

(b) New wells installed as part of the aquifer testing program

(c) FSR = Fish Springs Ranch

(d) 340 Feet from pumping well, unknown location

(e) U is not ≤ 0.01

response in Astor Pass MW #2 from pumping the Astor Pass test well was interpreted by Washoe County as suggestive of a fault which prevented flow across Astor Pass.

The results of the analysis of the aquifer test data were compared to estimates of these parameters obtained by the USGS from modeling. Table 4.0 compares estimates of transmissivity obtained from aquifer tests (Table 3.0) to the USGS model estimates of transmissivity obtained through review of well logs, consideration of the depositional environment and model calibration. As shown in Table 4.0, the estimates generally agree,

TABLE 4.0						
COMPARISON OF FIELD AND MODEL ESTIMATES OF TRANSMISSIVITY AND BOUNDARY CONDITIONS						
Well Common Name	Westec Well Number	Model Node Location	Field Transmissivity (ft ² /day)	Field Storativity	Boundary	Model Estimated Transmissivity (ft ² /day)
Hodges	24	25,21	29,412	1.78x10 ⁻³	B	32,374
Wilson (89 test)	19	28,16	9,224	7.84x10 ⁻³	NO	9,773
Ferrel	110	28,17	17,513	2.25x10 ⁻³	NO	18,139
Headquarters	20	28,19	31,016	7.7x10 ⁻³	NO	33,841
Jarboe (89 test) 7 days	17	29,19	49,688	3.2x10 ⁻¹	B	41,935
Astor Pass Test	128	21,22-21,23	5,180	4.7x10 ⁻⁵	B	4,257
Sand Pass	89	18,22	12,286	8.45x10 ⁻⁵	R	4,771
VES 8	16	28,16	1,765	-	R	9,773
B = Barrier or no flow boundary						
R = Recharge boundary						

with the exception of transmissivity estimates at Sand Pass and at VES-8 (well #16). In the Sand Pass area, the aquifer test data indicate a transmissivity of approximately 12,286 ft²/day. Model estimates in this area are somewhat lower at 4,771 ft²/day. The VES-8 well (well #16), located southeast of FSR, exhibited a transmissivity during field testing of 1,765 ft²/day, compared to model estimates of 9,773 ft²/day. The remaining transmissivity estimates generally agree.

In general, aquifer test data are in agreement with model estimates of aquifer parameters. In all but two locations, transmissivity values vary as little as 4 to 20 percent between field and model estimates. In the Sand Pass area, in the area of the Wilson well and at VES-8 estimates differ by a factor of 3 to 6. As the model estimates of transmissivity consider the regional distribution of transmissivity from calibration, the model estimate is considered more reliable for a regional analysis of the valley. The differing transmissivity values

obtained from aquifer tests at a particular point will result in some variation in drawdowns in a localized area compared to drawdowns obtained from a regional model simulation.

Caution should be exercised when comparing boundaries indicated from aquifer test data to the model boundaries. Limitations in applying the Theis solution to the aquifer test data discussed previously may result in incorrectly interpreting data as indicative of a boundary when it may represent something else such as leakage. Recognizing this limitation, it is interesting to contrast the field test data and USGS model. No-flow boundaries near the Hodges well indicated by the aquifer test data may support the no-flow boundary set in the model at the Virginia Mountains. Recharge in the Sand Pass area suggested during the field test may support the assumption of flow toward Smoke Creek Desert, and recharge at VES-8 may reflect the recharge entering the model from the south, as set in the model. The limited hydraulic communication in Astor Pass between the test well and monitoring well 2 has been interpreted by Washoe County investigators as a no-flow barrier at the Pass, in contrast to the USGS model. The aquifer test data from Astor Pass does indicate limited hydraulic communication between the pumping well and the monitoring well within the upper 500 feet of the aquifer tested, but does not definitively indicate a no-flow boundary at this location.

Water Quality Data

Water quality data in the form of general water quality parameters and isotope data were collected by Washoe County at numerous wells and springs in the valley from 1985 to 1991. These data were obtained from the water hearing transcripts and reviewed (Table 2.0, Exhibits 73 and 124). The purpose of the review was to include this information in the database and to evaluate whether any definitive new information on water quality had been obtained subsequent to the USGS modeling effort that would require modification of the USGS model. The general mineral data such as major anions and cations and total dissolved solids were reviewed, subjected to a data validation process, and incorporated as appropriate into the database. Isotope data were collected for springs and wells in the study area. Some of these data were submitted as exhibits in the water hearings. However, information on the original data, sample collection procedures and descriptions of the work performed was not submitted in the exhibits to the water hearings. As the isotope data available for review were not complete and the information could not be validated, isotope data were not used for this analysis.

4.2 Additional Water Level Data

Water levels in the valley have been monitored by the California DWR for wells in California. Additional water level data for California and Nevada are available from Washoe County and the USGS. These data were obtained and incorporated into the database. Information on well-water levels for each well is available from the BLM. Hydrographs of the historical water level data were constructed to determine if trends were evident. Hydrographs for selected wells are included as Figures 3.0a through 3.0g. Well locations are shown on Figure 2.0. The hydrographs selected in Figures 3.0a through 3.0g

were chosen to provide information in the main areas of concern, FSR, the SIAD, and Astor and Sand Passes, and are briefly discussed here.

Fish Springs Ranch

Water levels in wells that are pumped at FSR such as the Wilson well (well #19), Hodges (well #24), Jarboe (well #17) and Ferrel (well #18) exhibit a slight downward trend over the period of record, which ranges from 1976 to 1991 with most data collected from 1987 to 1989. The downward trend may be due to increases in pumping at FSR in the past few years. Water levels in wells in the FSR area that are not being pumped such as wells BB-2-A (well #101), Ferrel MW #1 (well #104), Ferrel Playa well (well #108), Hodges MW#1 (well #117) and Headquarters MW#2 (well #120) (Figure 3.0b and 3.0c) show a less evident overall downward trend or no decrease. Water level from wells somewhat outside the main pumping zones such as Cottonwood monitoring wells #1 and #2 (well #113 and #114), Cottonwood test (well #115) and Never Sweat MW#2 (well #116) do not show downward trends (Figure 3.0d). The localized downward trend indicates the basin is regionally in equilibrium or steady state with localized water level variations near pumping centers.

Sierra Army Depot (SIAD)

Water level data from wells at the SIAD are shown on Figure 3.0e. SIAD wells PSW-02 (well #45), 05 (well #46), 08 (well #48) and 09 (well #49) are used for water supply at the base. The water levels in these wells reflect continual pumpage with seasonal variations. Water levels were recorded at the time of well installation as indicated by the first data point on each graph and represent the well driller's estimate of first water encountered during drilling. The early water level data are probably influenced by existing pumpage at the Depot, which has been ongoing since 1942. Additional water level data were not collected until 1984 or 1985 so evaluation of water level trends over time is difficult. Water levels from unpumped wells approximately 2 to 10 miles north of the SIAD water supply well field from SIAD well #10 (well #5), SIAD well #1 (well #6), SIAD well #6 (well #7) and SIAD well #11 (well #9) are relatively stable over the limited period of record available; 1987 to 1991 (Figure 3.0f). Hydrograph data at the Depot indicate steady state conditions are evident outside the main pumping centers.

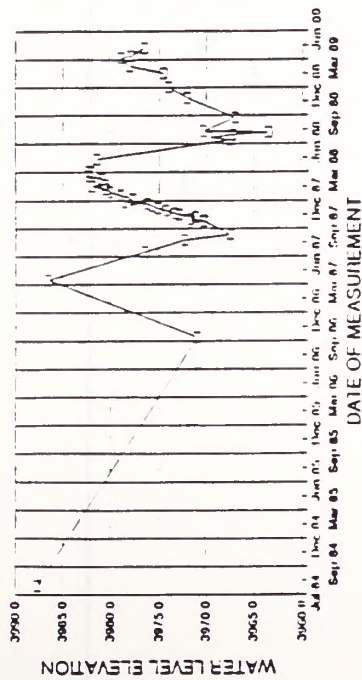
Astor and Sand Passes

Hydrographs at Astor and Sand Pass indicate water levels are relatively stable in these areas (Figure 3.0g).

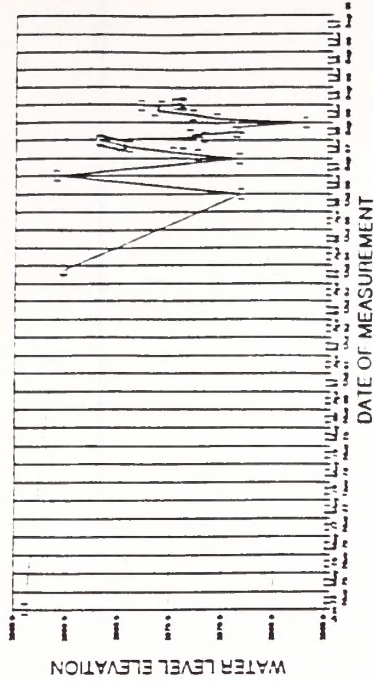
In general, historical water level data suggest the Honey Lake Valley groundwater basin is in a steady state with some downward water-level trends near pumping centers probably related to increased and variable pumpage in these areas.

The data review indicates that the USGS flow model will reasonably simulate groundwater flow conditions in the eastern section of Honey Lake Valley. The western section of eastern Honey Lake Valley at the SIAD requires further refinement. The USGS model, with

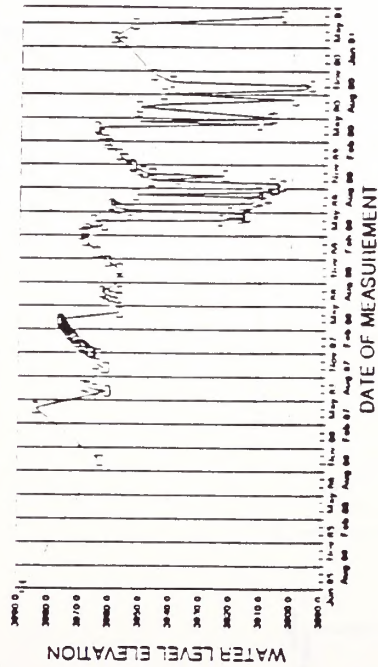
WELL #17 (JARBOE WELL)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #18 (FERRELL WELL)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #19 (WILSON WELL)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #24 (HODGES WELL)
WATER LEVEL ELEVATIONS (FT. MSL)

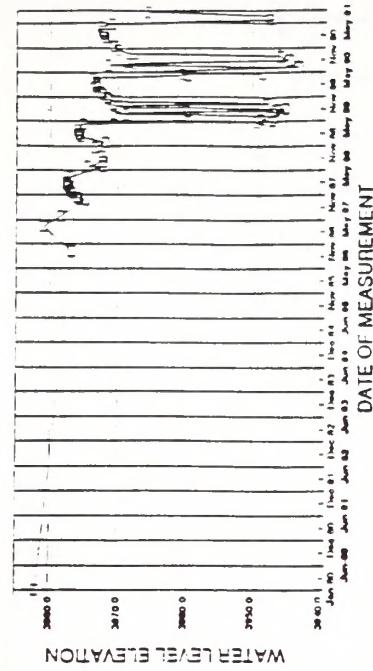
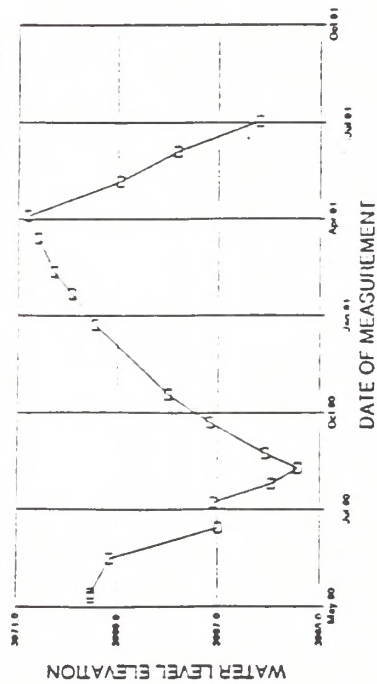
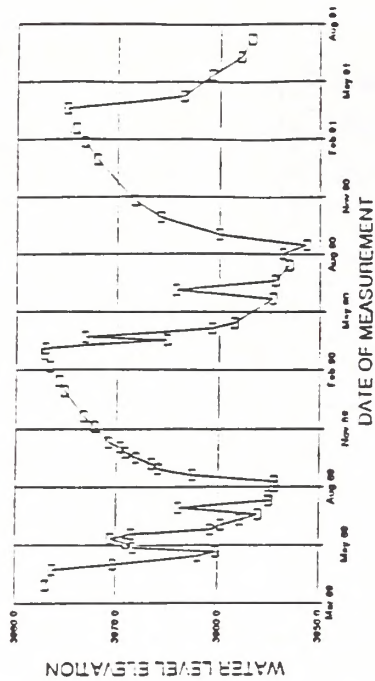


FIGURE 3.0a
HYDROGRAPHS

WELL #101 (BB2-A)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #104 (FERRELL MW#1)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #108 (FERREL PLAYA WELL)
WATER LEVEL ELEVATIONS (FT. MSL)

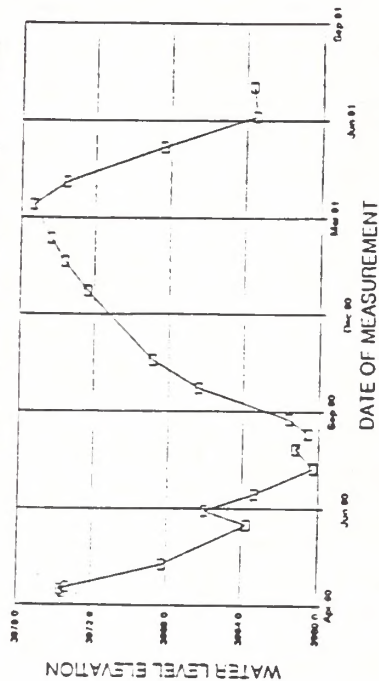
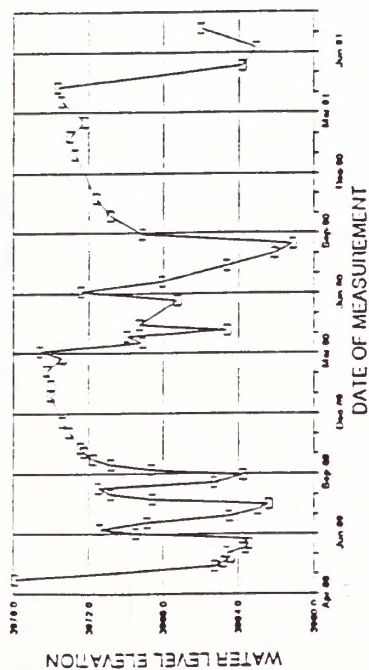


FIGURE 3.0b
HYDROGRAPHS

WELL #117 (HODGES MW#1) WATER LEVEL ELEVATIONS (FT. MSL)



WELL #120 (HEADQUARTERS MW#2) WATER LEVEL ELEVATIONS (FT. MSL)

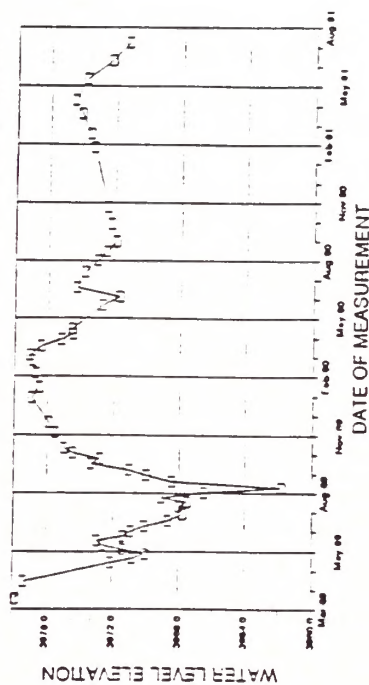
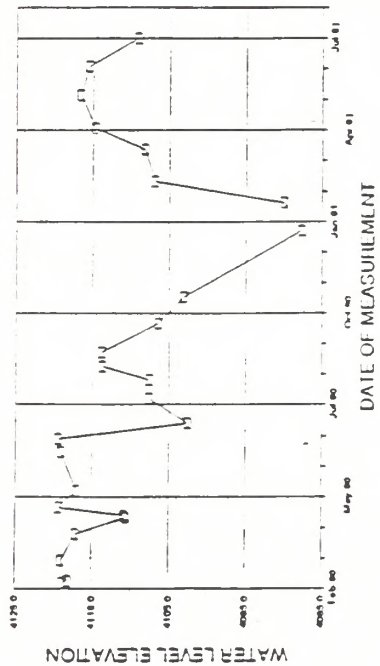
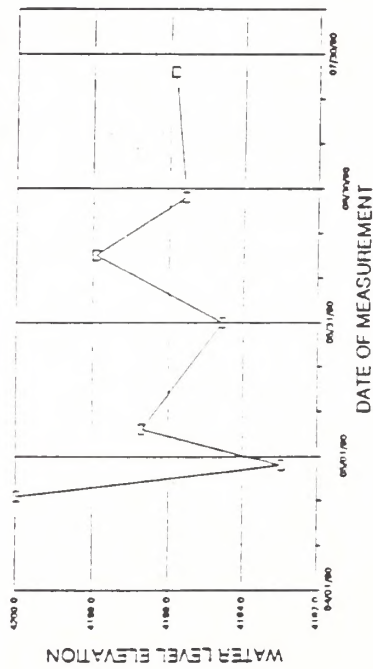


FIGURE 3.0c
HYDROGRAPHS

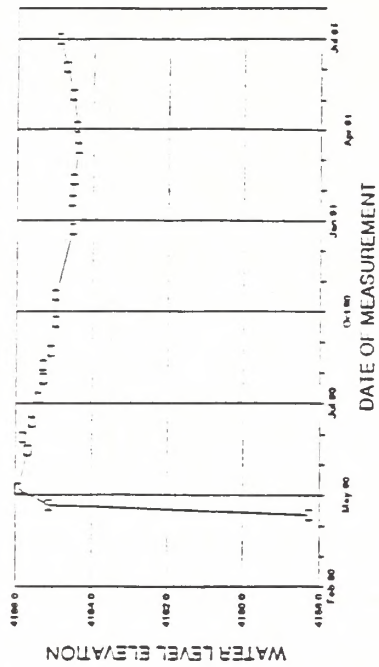
WELL #113 (COTTONWOOD MW#1)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #115 (COTTONWOOD TEST)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #114 (COTTONWOOD MW#2)
WATER LEVEL ELEVATIONS (FT. MSL)



WELL #116 (NEVER SWEAT MW#2)
WATER LEVEL ELEVATIONS (FT. MSL)

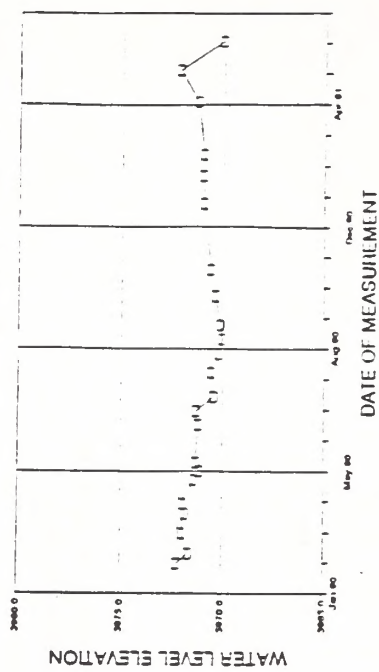


FIGURE 3.0d
HYDROGRAPHS

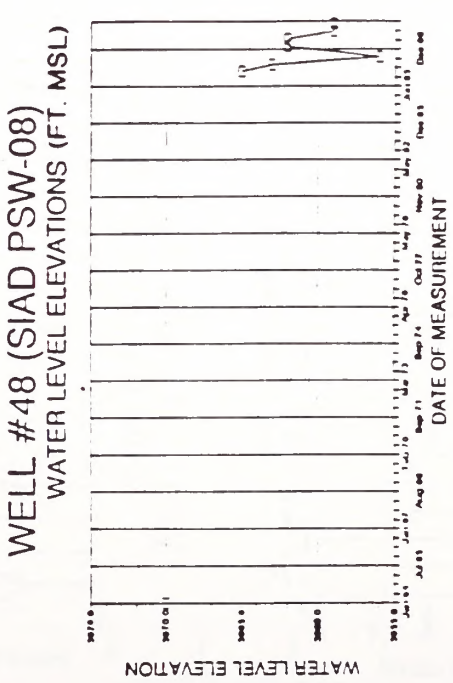
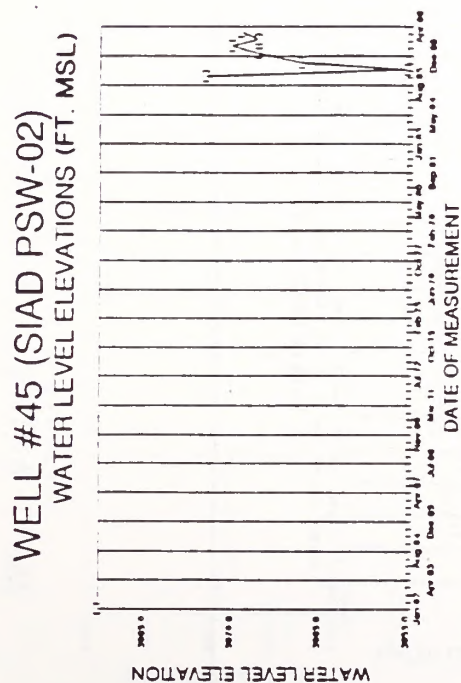
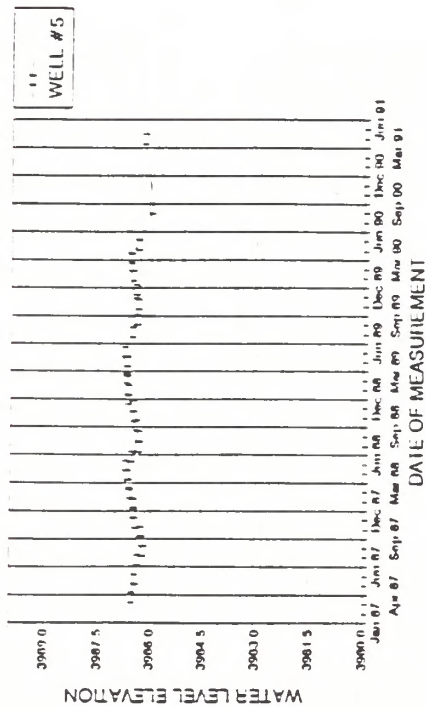


FIGURE 3.0e
HYDROGRAPHS

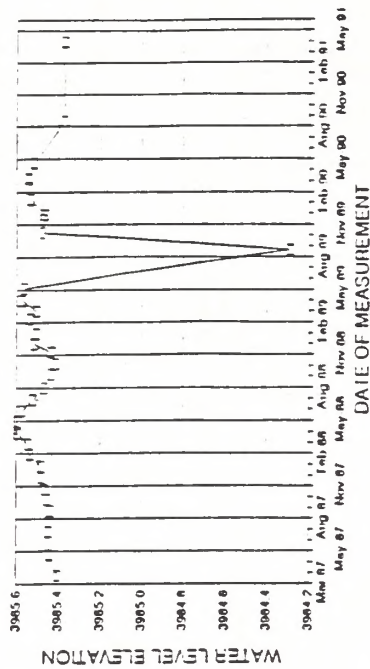
WELL #5 (SIAD WELL #10)

WATER LEVEL ELEVATIONS (FT. MSL)



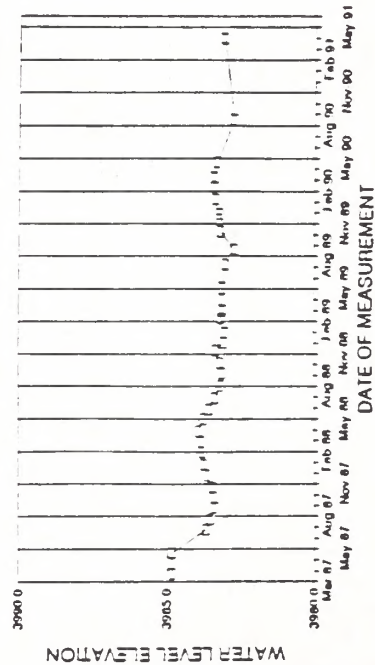
WELL #6 (SIAD WELL #1)

WATER LEVEL ELEVATIONS (FT. MSL)



WELL #7 (SIAD WELL #6)

WATER LEVEL ELEVATIONS (FT. MSL)



WELL #9 (SIAD #11)

WATER LEVEL ELEVATIONS (FT. MSL)

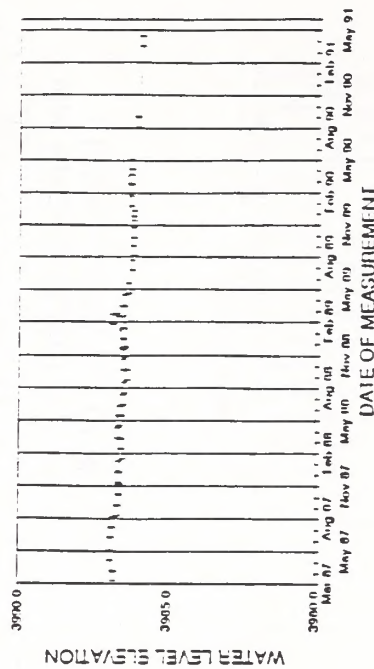


FIGURE 3.01
HYDROGRAPHS

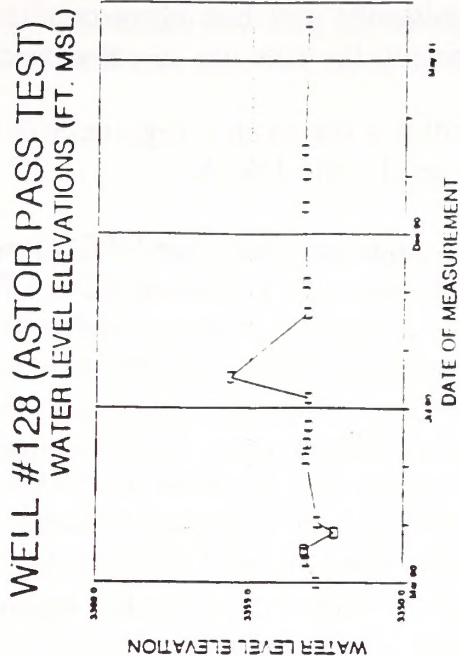
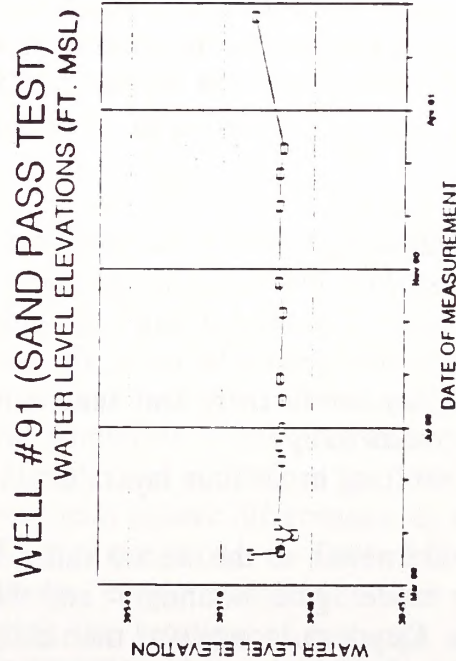
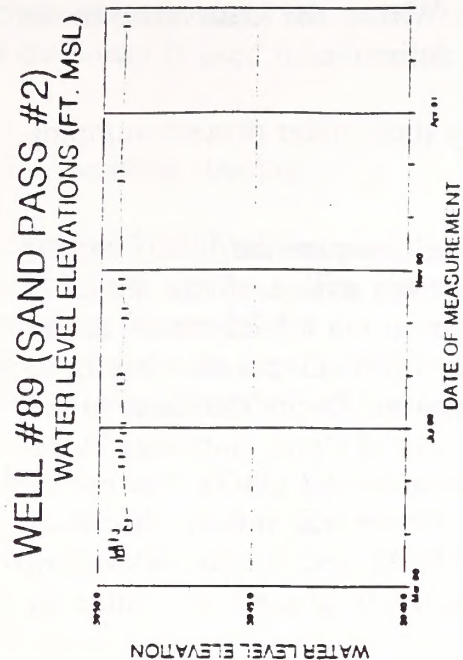
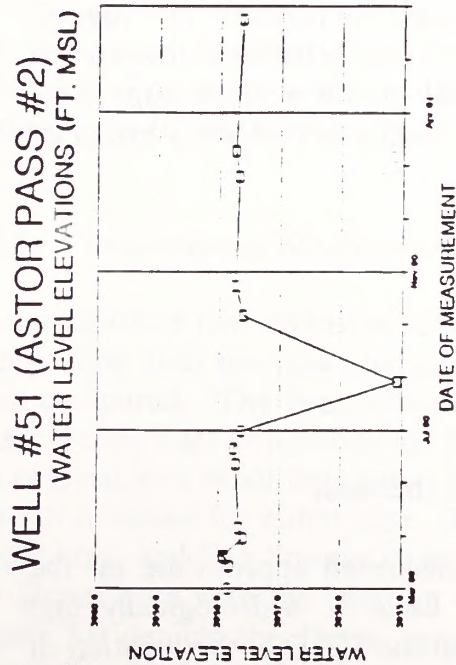


FIGURE 3.0g
HYDROGRAPHS

modification at the SIAD, can therefore be used to evaluate environmental impacts based on the following:

1. Aquifer test data generated by Washoe County is in general agreement with the model estimates of transmissivity and boundary conditions. Where the data are not in agreement, the variation in estimates is not considered definitive.
2. Hydrograph data indicate the basin is regionally in steady state under present pumping conditions, as assumed by the USGS.

The SIAD area requires modification in the USGS flow model because the USGS model was designed to simulate flow in the area of FSR. The western extent of the model is located at the Depot. As a result, the boundary conditions set in the USGS model at the western edge of the model do not allow an accurate simulation of the Depot area itself. In addition, the model does not extend far enough south to incorporate Depot pumpage at the correct SIAD water supply well locations. To allow incorporation of Depot pumpage in the model, and to more accurately simulate flow conditions in this area, the USGS flow model was modified to include this area, as discussed in Section 5.0. Other than this modification, no other changes have been made to the USGS model. The USGS model with the western modification was used to evaluate environmental impacts related to groundwater quantity and quality.

5.0 Modification of USGS Model

To allow a more accurate simulation of the SIAD area, the western edge of the USGS flow model was extended approximately three miles from its present configuration. Figure 2.0 depicts the new and old grid boundaries. The model grid was extended to the edge of Honey Lake in most areas except in the southwest where it was extended toward the Diamond Mountains. All conditions set in the USGS model at the western edge were assumed to apply to the 3 mile extended area. The model conditions that were extended were:

1. Hydraulic conductivity
2. Initial groundwater surface elevation for all layers
3. Recharge
4. Evapotranspiration
5. General head boundary conductivity and head values
6. Vertical hydraulic conductivity
7. Aquifer thickness resulting in all four layers extended to the west

Extending the aquifer parameters to the west 3 miles was considered appropriate as the area between the old model grid boundary and Honey Lake is hydrologically and geologically very similar. Depot pumpage was then assigned to the SIAD at the location of their four water supply wells, designated by WESTEC well numbers #45, #46, #48 and #49, corresponding to Depot SIAD well numbers PSW-02, PSW-05, PSW-08 and PSW-09. A well field pumping rate of 2,000 acre-ft/yr was assumed to be removed from the aquifer

based on information on water usage supplied by SIAD. This value is the average upper limit of pumpage at the Depot. Fifty-seven percent of the total amount pumped was assigned to PSW-02 and PSW-08 and 43 percent of the total amount pumped was assigned to wells PSW-05 and PSW-09. The pumpage was assigned to model layers based on the screened intervals of the wells. No irrigation return flow was incorporated into the model as the water is used for domestic purposes and was assumed to be consumed.

5.1 Sensitivity Analysis

A sensitivity analysis was performed to evaluate what effect the extension of the model had on the flow system. The purpose of the sensitivity analysis was to demonstrate that extending the model did not change the simulation of flow conditions. To demonstrate this, the root mean square difference in heads (RMSD) at various locations throughout the grid were calculated under various scenarios. The RMSD is defined as:

$$\begin{array}{ll} H_1 = & \text{model No. 1 simulated water level} \\ H_2 = & \text{model No. 2 simulated water level} \\ N = & \text{total number of measurements} \end{array} \quad (1) \quad RMSD = \sqrt{\frac{\sum (H_1 - H_2)^2}{N}}$$

It is used to provide an estimate of the average difference in heads (or water levels) considering the number of measurements used. It is different from the root mean square error (RMSE) used by the USGS in Report No. 90-4050, where observed head values were compared to model-simulated values. Three types of sensitivity analyses were performed: (1) comparison of the modified grid and original grid simulations of the groundwater regime under 1988 conditions to demonstrate that the 3 mile extension of the grid did not significantly alter the flow regime, with particular emphasis on the FSR area; (2) sensitivity analyses to demonstrate that the modified grid is sensitive to the same parameters and to the same level of affect as the original grid; and (3) sensitivity analyses to evaluate the influence of recharge and evapotranspiration on the extended grid. Each is described in detail in the following sections.

5.1.1 Comparison of Modified and Original Grid Using 1988 Hydrologic Conditions

To demonstrate that extension of the original grid approximately 3 miles to the west did not significantly alter the flow characteristics of the original model, two computer simulations were compared. The hydraulic head in all four layers predicted using the modified grid under steady state conditions for 1988 was compared to the predicted hydraulic heads for the original grid in all four layers under steady state conditions for 1988. Depot pumpage was not included for either case. The root mean square differences for the entire grid, the Depot area, and Fish Springs Ranch (FSR) area are shown on Table 5.0. Figure 4.0 depicts the Depot area with the location of recharge, evapotranspiration and model boundaries. Figure 5.0 depicts the Depot area showing the location of recharge and discharge and evapotranspiration cells. The areas in the model used to calculate the head difference are shown on Figure 5.0.

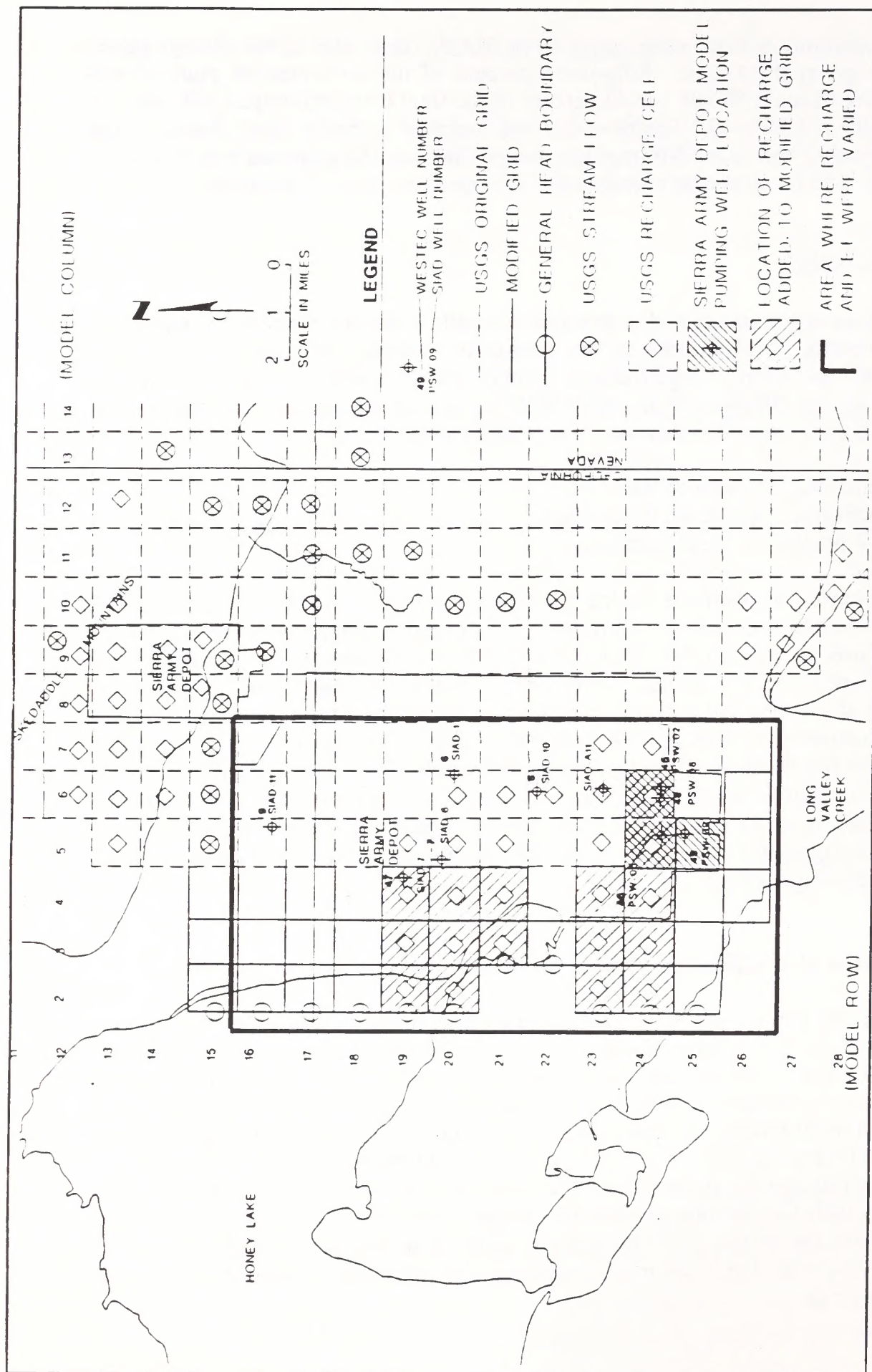


FIGURE 4.0
MODIFIED USGS GRID WITH DEPOT WELL LOCATIONS

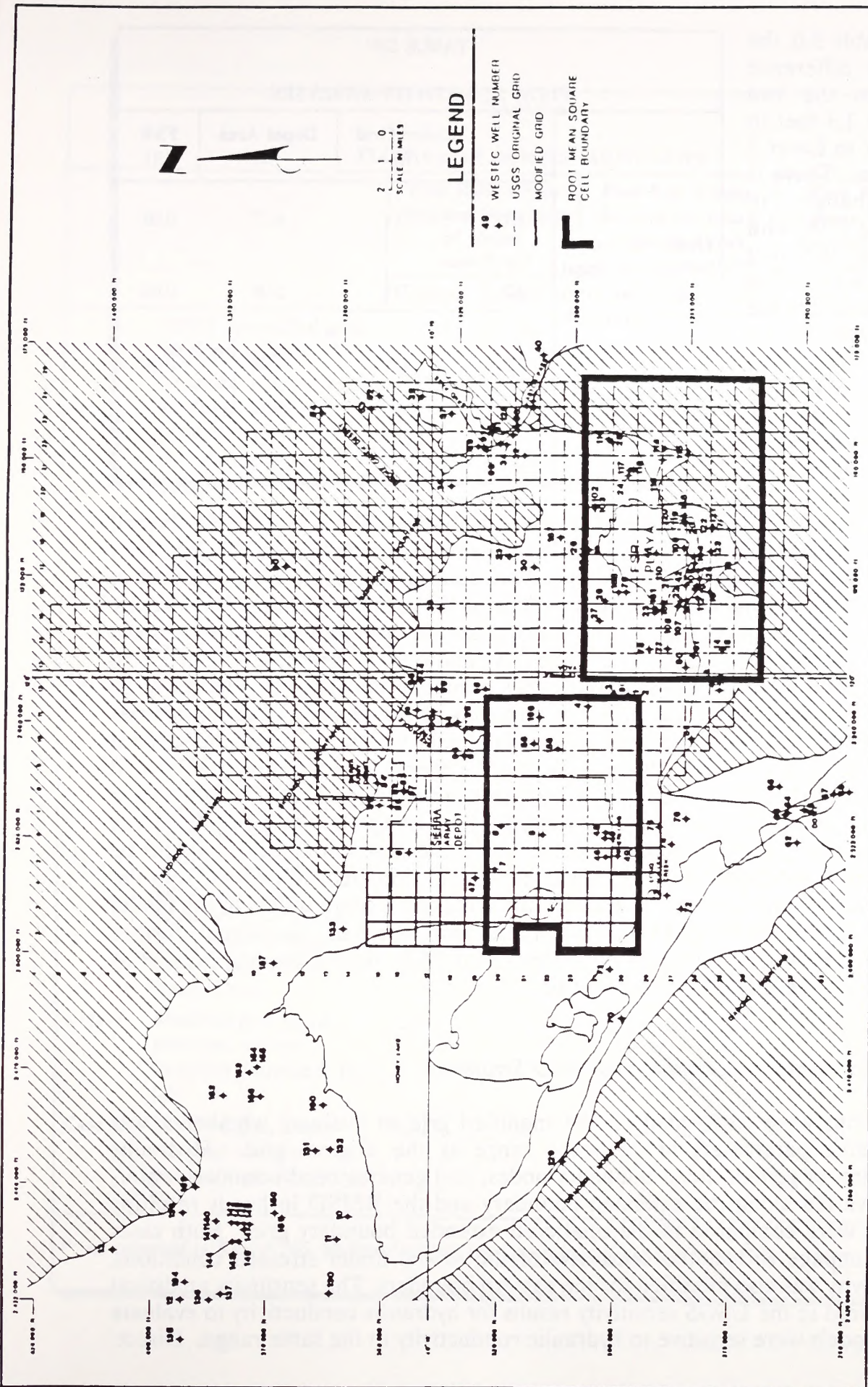


FIGURE 5.0

**LOCATION OF CELLS USED IN THE FLOW MODEL
TO CALCULATE ROOT MEAN SQUARE DIFFERENCE
AT THE SIERRA ARMY DEPOT, AND FISH SPRINGS RANCH**

As indicated in Table 5.0, the root mean square difference in heads between the two cases ranges from 1.3 feet in Layer 4 to 5.0 feet in Layer 2 for the Depot area. There is virtually no change in predicted heads at FSR with changes of less than 0.09 feet for all four layers. The RMSD in head values for the entire model varies from 1.4 to 1.8 feet. The head differences shown in Table 5.0 are generally less than the model calibration error of 5 feet used by the USGS for calibrating the original model

TABLE 5.0				
FLOW SENSITIVITY ANALYSES				
Head difference between Original Unmodified Grid and Modified Grid.	Entire Grid (ft)		Depot Area (ft)	FSR (ft)
	L1	1.514	4.57	0.08
	L2	1.731	5.06	0.09
	L3	1.421	3.64	0.09
	L4	1.759	1.25	0.07

and demonstrates that extending the model 3 miles to the west did not alter the overall groundwater flow regime as simulated by the USGS. To further demonstrate this fact, flow volumes per unit time across critical boundaries were calculated for the modified grid to allow comparison with the original model simulations of flow across the same boundaries. Table 6.0 summarizes these flow rates. As indicated on the table, inflow to the western edge of the model increased from 580 to 725 acre-ft/yr and outflow decreased from 590 to 100 acre-ft/yr. Flow rates across eastern boundaries remained unchanged. The variation in western boundary flows reflects the different locations of the general head boundaries between the modified grid (where the general head boundary location is along the western edge of Honey Lake) and the original grid (where the general head boundary is located approximately 3 miles east of Honey Lake in the interior of the Sierra Army Depot). In the Honey Lake/Depot area the groundwater gradient is extremely flat, particularly in the shallow aquifer (Layers 1 and 2). Small fluctuations in the gradient direction would be expected the closer the boundary is to Honey Lake, due to localized influences from the lake recharging shallow groundwater. As a result, there is slightly more inflow to the model in the modified grid at the lake edge than in the original grid where the boundary is farther to the east. Flow rates in the main area of concern near FSR, Astor Pass and Sand Pass remain unchanged as a result of the modification.

5.1.2 Boundary Conductivity, Location, and Head Sensitivity

Sensitivity simulations were performed on the modified grid to evaluate whether it was sensitive to the same parameters in the same range as the original grid. Hydraulic conductivity, location of general head boundary nodes, and general head boundary water-level values were varied along the extended boundary and the RMSD in heads resulting from the variation were compared to the unaltered extended boundary grid. Both cases included Depot pumpage to test the sensitivity of the model under stressed conditions. Hydraulic conductivity was also modified for the eastern boundary. The sensitivity analytical results were compared to the USGS sensitivity results for hydraulic conductivity to evaluate whether the two models were sensitive to hydraulic conductivity in the same range. Direct

TABLE 6.0

FLOW RATES ACROSS BOUNDARIES

		Flow Rate Across Western Boundary of Model (acre-ft/yr)		Flow Rate Across Eastern Boundary to Smoke Creek Desert (acre-ft/yr)		Flow Rate Across Eastern Boundary to Pyramid Lake Valley (acre-ft/yr)	
		Inflow	Outflow	Inflow	Outflow	Inflow	Outflow
	USGS unmodified grid, no depot pumpage ^(a)	580	590	0.0	5,300	0.0	1,500
	Modified grid, no Depot pumpage, 1988 conditions	725	94	0.0	5,300	0.0	1,500
	Modified grid, Depot pumpage	1,253	62	0.0	5,300	0.0	1,500
Case 1	Modified grid, Depot pumpage, K Decreased by 0.5 in west	942	43	0.0	5,300	0.0	1,500
Case 2	Modified grid, Depot pumpage, K increased by 10 in west	3,972	181	0.0	5,300	0.0	1,500
Case 3	Modified grid, Depot pumpage, boundary moved east 1 mile	1,385	139	0.0	5,300	0.0	1,500
Case 4	Modified grid, Depot pumpage, western boundary lowered to Dry Lake level	780	139	0.0	5,300	0.0	1,500
Case 5	Modified grid, Depot pumpage, western boundary to Dry Lake level, lower recharge head 70 feet at Long Valley Creek	736	135	0.0	5,300	0.0	788
Case 6	Modified grid, depot pumpage, eastern boundary decrease K by 0.5	1,246	65	0.0	3,079	0.0	788
Case 7	Modified grid, Depot pumpage, eastern boundary increase K by 10	1,327	34	0.0	6,868	0.0	5,618

^(a) As reported in Report No. 90-4050 for 1988 baseline pumping conditions at FSR

comparisons between the modified and original USGS models were not possible for moving general head boundaries and varying boundary water levels as these parameters were not evaluated for the original grid by the USGS. The results of the sensitivity analyses are summarized in Table 7.0. Also, for comparison purposes the flows in acre-ft/yr across Honey Lake, to Smoke Creek Desert and to Pyramid Lake Basin are summarized and compared to the same estimates for the original grid values (Table 6.0). Tables 6.0 and 7.0 indicate:

TABLE 7.0					
SENSITIVITY ANALYSIS OF WESTERN GRID EXTENSION (RMSD IN HEADS)					
Honey Lake and Long Valley	Modified Grid				USGS Unmodified Grid Entire Grid (ft)
		Entire Grid (ft)	Depot Area (ft)	FSR (ft)	
CASE 1 Decrease K by 0.5	L1	2.32	6.39	0.07	---
	L2	2.44	6.5	0.08	---
	L3	1.49	4.3	0.09	---
	L4	0.57	1.89	0.08	---
	Average	1.7	4.77	0.08	2 - 4
CASE 2 Increase K by 10	L1	4.5	12.3	0.13	---
	L2	5.2	13.9	0.14	---
	L3	3.4	10.1	0.15	---
	L4	0.8	2.6	0.13	---
	Average	3.4	9.7	0.14	2 - 4
CASE 3 Move Western Boundary 1 Mile East to Model Column 3	L1	1.8	5.2	0.07	---
	L2	2.1	5.4	0.09	---
	L3	1.3	3.9	0.09	---
	L4	0.73	2.4	0.09	---
	Average	1.5	4.2	0.09	Not Simulated
CASE 4 Decreased Head at Western Boundary to 3,977.5 Feet Dry Lake Level	L1	1.5	4.2	0.07	---
	L2	1.8	4.4	0.09	---
	L3	1.8	4.1	0.1	---
	L4	1.9	4.1	0.09	---
	Average	1.8	4.2	0.09	Not Simulated
CASE 5 Decreased Head at Western Boundary to 3,977.5 Feet Decreased Head 70 Feet at Long Valley Creek	L1	3.1	8.6	0.09	---
	L2	3.3	8.7	0.1	---
	L3	2.3	5.7	0.1	---
	L4	1.9	4.4	0.1	---
	Average	2.7	6.9	0.09	---

TABLE 7.0 (continued)						
SENSITIVITY ANALYSIS OF WESTERN GRID EXTENSION (RMSD IN HEADS)						
SMOKE CREEK DESERT AND PYRAMID LAKE	Modified Grid					USGS Unmodified Grid Entire Grid
	Entire Grid		Depot Area	FSR	Eastern(a) Boundary	
CASE 6 Decreased K in East by 0.5	L1	4.3	0.4	2.7	10.7	- - -
	L2	4.5	0.5	3.1	10.2	- - -
	L3	4.6	0.8	3.5	9.5	- - -
	L4	5.0	1.2	4.13	9.3	- - -
Average	4.6		0.73	3.35	9.9	5 - 6
CASE 7 Increased K in East by 10	L1	33.1	5.8	40.2	66.0	- - -
	L2	34	6.4	43.5	64.5	- - -
	L3	35.5	9.0	45.8	63.2	- - -
	L4	37.8	12.2	49.1	63.5	- - -
Average	35.1		8.4	44.7	64.3	40 - 42
(a) Eastern boundary includes Smoke Creek Desert and Pyramid Lake Basin						

1. The western boundary is somewhat sensitive to changes in hydraulic conductivity and exhibits the same sensitivity as the original grid in this area as shown by the RMSD of 6-12 feet in Layers 1 and 2 (Case 1 and 2 of Table 7.0). Flow rates vary across the western boundary as a result of either decreasing or increasing hydraulic conductivity. The variation is similar in flow rates for the modified and original grid, with somewhat higher sensitivity in the modified grid.
2. Moving the general head boundary 1 mile closer to pumping (Case 3, Table 7.0) has a small influence on the head values at the SIAD. This is supported by the similarity in flow rates across the western boundary regardless of the location of the general head boundary (Table 6.0).
3. The head value assigned to the general head boundary at Honey Lake can be decreased to the altitude of a dry lake reported at 3,977.5 feet (Rockwell, 1990), and only affect the heads at the Depot by 4.1 to 4.4 feet RMSD (Case 4, Table 7.0). Flow across the western boundary decreased approximately 400 acre-ft/yr, suggesting some sensitivity to head values assigned in the west (Case 4, Table 6.0).
4. Head values assigned in the southwest corner of the model at Long Valley Creek can be reduced by approximately 70 feet with little effect on head values (Case 5, Table 6.0). The head varies an additional plus or minus 4 feet RMSD at the Depot when compared to Case 4, and 8 feet when compared to the unaltered extended grid. Flow rates across the western boundary also are relatively constant compared to Case 4, indicating limited influence from water levels assigned at Long Valley Creek. This indicates Long Valley Creek has little effect on flow conditions within the model.

5. Head values and flow rates were affected due to changes in hydraulic conductivity and general head boundary water levels. When hydraulic conductivity is decreased by 0.5, the average RMSD in heads is 4.77 feet at the Depot; when increased by 10, the average RMSD in heads is 9.7 feet. The overall model RMSD is 3.4 feet, similar to the sensitivity of the USGS original model. Flow rates across the western boundary are influenced by the variation in hydraulic conductivity as well.
6. Changes to hydraulic conductivity in the eastern boundaries to Smoke Creek Desert and Pyramid Lake Basin result in significant changes in heads and flow rates when compared to the unaltered modified grid, particularly in the FSR area and the eastern boundary (Case 6 and 7, Table 7.0). The magnitude of sensitivity is equivalent to the same sensitivity exhibited in the original grid reported by the USGS.
7. Modification of the grid in the west and varying hydraulic conductivity and general head boundary conditions in the west have no impact on inflow and outflow rates to Smoke Creek Desert or Pyramid Lake Basin. Extension of the model grid and Depot pumpage increases inflow to the model at Honey Lake or flow to the east from 580 acre-ft/yr to 1,253 acre-ft/yr and reduce outflow or flow to the west from 590 to 62 acre-ft/yr, compared to no Depot pumpage in the unmodified grid. Varying the hydraulic conductivity in the east results in a significant variation in outflow to Smoke Creek Desert and Pyramid Lake Basin, but it has no significant impact on flow rates in the Depot area, as was the case in the USGS model.

5.1.3 *Recharge and Evapotranspiration*

Recharge and evapotranspiration rates in the 3 mile extended area of the modified grid was assumed to be the same as in the unmodified grid in this area (Figure 4.0). This assumption is considered to be reasonable as the 3 mile extended area is hydrologically and geologically very similar to the western edge of the original grid. The average flow rates for areal recharge per model cell in the extended grid for infiltration of direct precipitation are 119 to 2,267 ft³/day or 0.9 to 19 acre-ft/yr. This is a very small areal recharge number as would be expected in the interior of a desert valley. Evapotranspiration rates vary from 2,841 to 9,127 ft³/day or 24 to 76 acre-ft/yr per model cell, also representing a small evapotranspiration flux, as evidenced by the sparse amount of natural vegetation at the Depot and the lake edge.

To demonstrate the impact of recharge and evapotranspiration on the extended area of the modified grid, sensitivity analyses were performed where the assumed estimates of recharge and evapotranspiration were varied by 2, 5 and 10 times and the resulting change in groundwater levels calculated. Table 8.0 summarizes the results of this analysis. Figure 4.0 shows the area where ET and areal recharge were varied. As indicated in Table 8.0, varying recharge up to 10 times the original values resulted in an average root mean square difference of 1.2 feet for the entire grid and maximum of 8.6 feet in the Depot area. Increasing evapotranspiration by as much as 10 resulted in an overall average change in Layer 1 of 0.07 feet for the entire grid and a maximum change of 0.6 feet. When recharge and evapotranspiration are both simultaneously increased by a factor of 10, the average

RMSD and maximum are similar. Comparisons cannot be directly made between model sensitivity of recharge and evapotranspiration in the extended grid area in the western section of the modified model and sensitivity to these same parameters estimated by the USGS for the original model. This is because recharge and evapotranspiration rates vary greatly throughout the model with much higher flow rates in the FSR area. The RMSD in head was only calculated for the entire model by the USGS and would tend

to over-predict sensitivity relative to flow rates in the Depot area. The information obtained by evaluating recharge and evapotranspiration sensitivity in the Depot area for the modified model indicates that the assumption of recharge and evapotranspiration is reasonable and consistent with the original assumptions in this area, and varying these estimates will not appreciably influence the flow system.

The sensitivity analyses indicate that where comparisons can be made, the modified grid has very similar sensitivities to parameter changes as the unmodified grid. The 3 mile extension of the model in the west has a minor influence on the flow conditions in the extended area and no affect on flow conditions, head values or boundary flow rates in the FSR area which is the focus of this analysis. As a result, the modified grid can be used to accurately simulate groundwater flow conditions from project pumping in all areas of the model based on the assumptions and limitations stated by the USGS for the USGS model.

5.2 SIAD Pumpage

The modified grid, as described in Section 5.0, was used to simulate SIAD pumpage of 2,000 acre-ft/yr and 1988 baseline pumping at FSR of 5,910 acre-ft/yr. The resulting drawdown from the pumpage at the Depot is shown in Figures 6.0a, 6.0b, 6.0c and 6.0d corresponding to drawdown in Layers 1, 2, 3 and 4. These figures represent the computer simulated drawdown for all four layers using the modified grid. It was calculated by subtracting the groundwater surface created when pumping 5,910 acre-ft/yr at the FSR, no SIAD pumpage, and the groundwater surface elevation generated when pumping 5,910 acre-ft/yr at FSR and 2,000 acre-ft/yr at the SIAD. The result is the drawdown due to SIAD pumping alone. As

TABLE 8.0 RECHARGE AND EVAPOTRANSPIRATION SENSITIVITY ANALYSES		
Table 7.5	RMSD in Heads - Entire Modified Grid Layer 1	
	Maximum	Average
Increase recharge in extended grid by 2	2.0	0.19
Increase recharge in extended grid by 5	5.4	0.63
Increase recharge in extended grid by 10	8.6	1.20
Increase ET in extended grid by 5	0.3	0.04
Increase ET in extended grid by 5	0.6	0.07
Increase ET in extended grid by 10	0.6	0.07
Increase ET and recharge in extended grid by 2	1.9	0.18
Increase ET and extended grid by 5	5.1	0.60
Increase ET and recharge in extended grid by 10	8.2	1.12

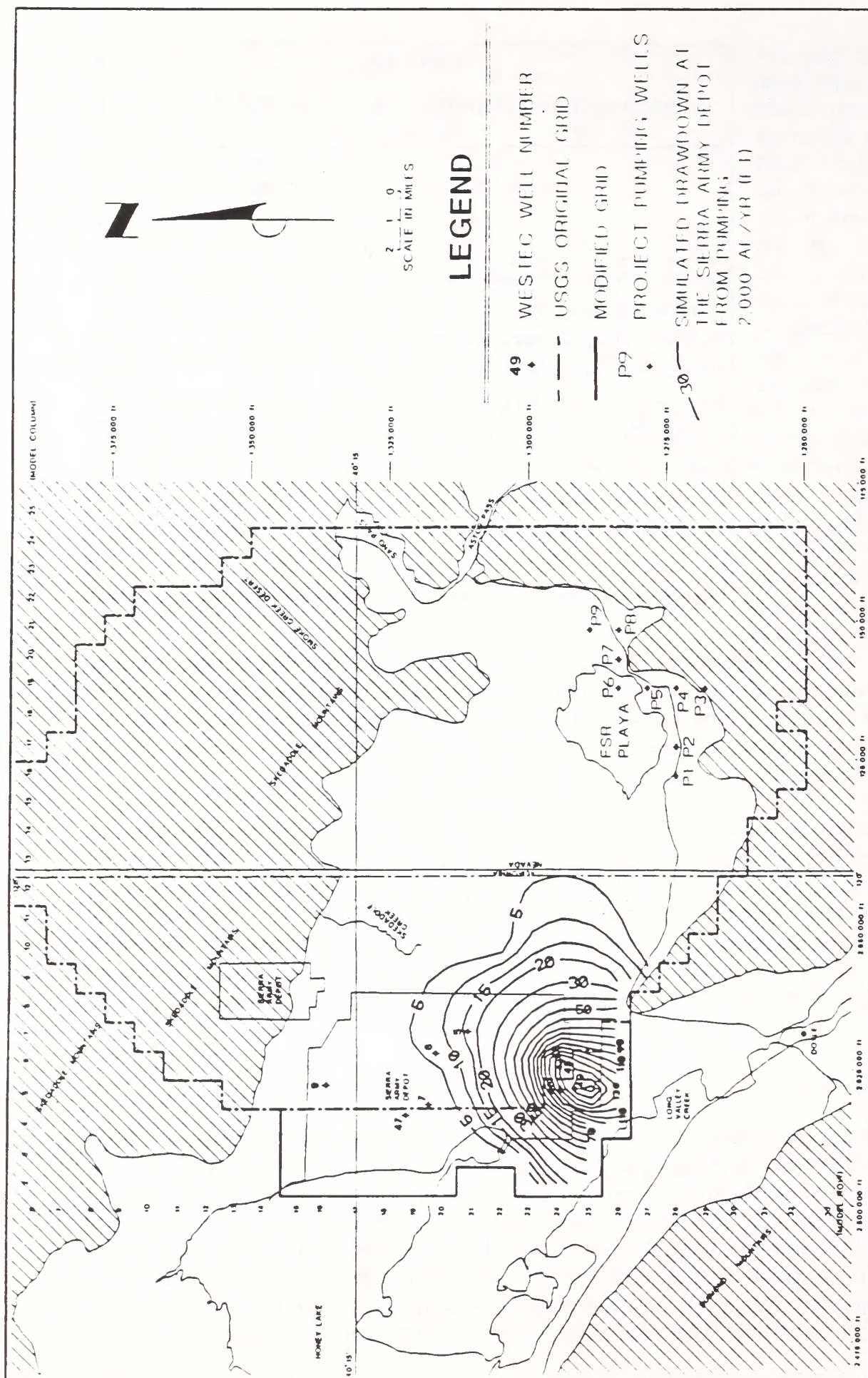


FIGURE 6.0a
MODIFIED USGS MODEL DRAWDOWN
AT THE SIERRA ARMY DEPOT LAYER 1

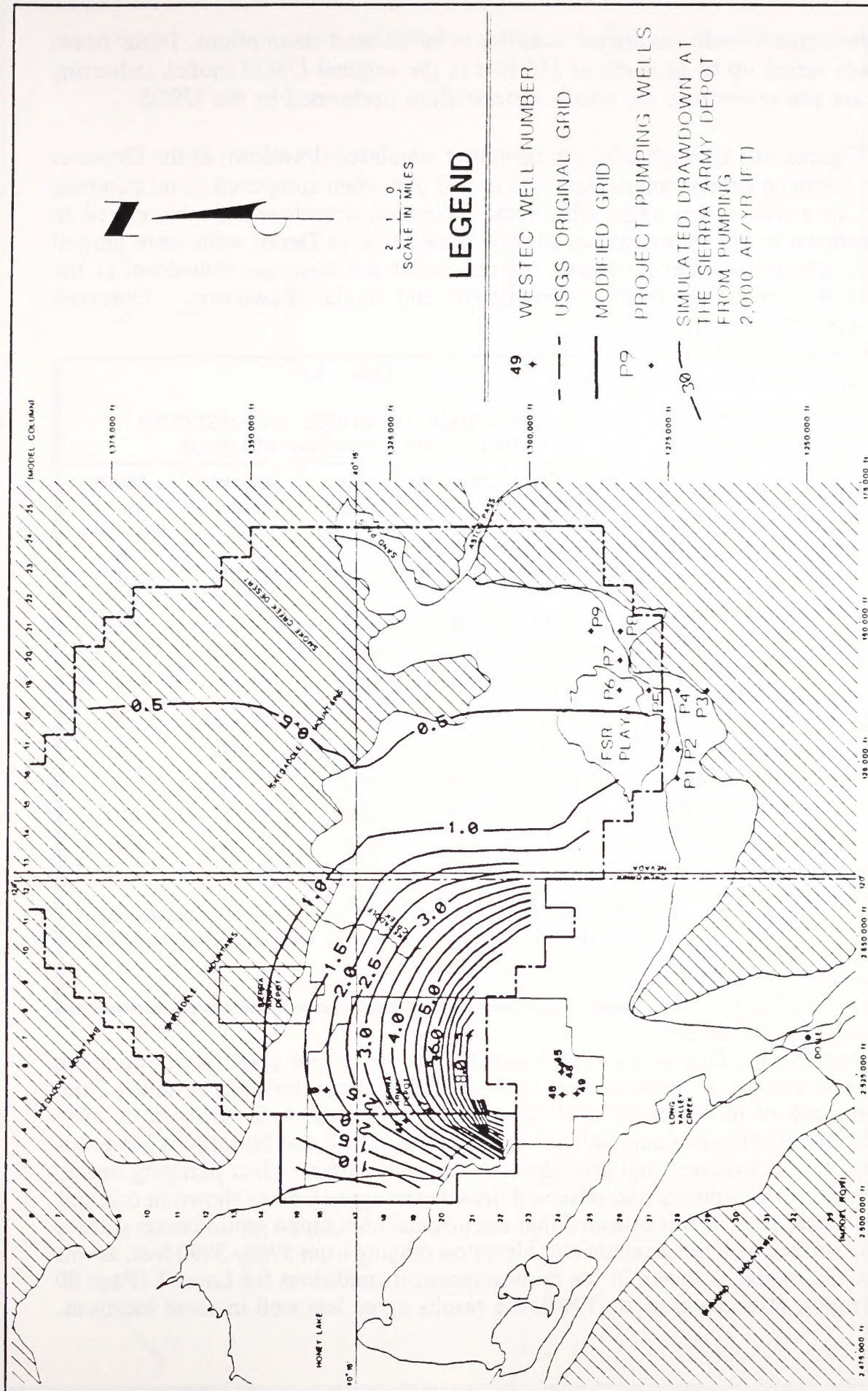


FIGURE 6.0d
MODIFIED USGS MODEL DRAWDOWN
AT THE SIERRA ARMY DEPOT LAYER 4

a result, the predicted drawdowns are not sensitive to initial head assumptions. Initial heads and final heads varied up to as much as 112 feet in the original USGS model, indicating initial heads are not relevant to the steady state analysis performed by the USGS.

As shown in Figures 6.0a through 6.0d, the computer simulated drawdown at the Depot at the well field pumping center ranges from 140 to 160 feet when compared to no pumping in the area. To evaluate how reasonable these estimated drawdowns are compared to observed drawdown at the Depot, observed 1988 drawdowns in Depot wells were plotted on Figure 7.0. Depth to water on Figure 6.0 represents the observed drawdown at the SIAD. Table 9.0 compares observed drawdowns and model drawdowns. Observed

drawdowns were obtained from water level data from the Sierra Army Depot which were collected by measuring from the top of the well casing to the groundwater level in the well. Drawdown data were measured during pumping for wells PSW-02, 05, 08 and 09 and vary due to variable pumping rates occurring during the process of measuring the water levels in the wells, as well as varying times when levels were measured before and after pumping began. A range in drawdown data is reported to reflect the uncertainty of the water level measurement data available for the pumping wells. A comparison of these two values indicates the magnitude of the drawdown predicted by the model generally agrees with observed drawdown data, with most model simulated drawdown estimates within 1 to 40 percent

of observed drawdowns. Due to limited information in the Depot area on pre-pumping water levels, it is difficult to estimate the groundwater surface elevation resulting from pumpage. The lack of initial water level data was noted by the U.S. Army in its 1988 Environmental Master Plan as a data deficiency (U.S. Army Toxic and Hazardous Materials Agency, 1988). If it is assumed that groundwater was near surface when pumping began, then model predicted drawdowns and observed drawdowns agree well as shown in columns (C) and (D) of Table 10.0. If it is assumed that the original unpumped groundwater surface was below land surface with the groundwater elevation ranging from 3980 - 3990 feet, as was done in the USGS model as shown in the predevelopment conditions for Layer 1 (Page 80 of the USGS report (Handman et al., 1990), the results agree less well in some locations.

TABLE 9.0				
COMPARISON OF MODEL AND OBSERVED DRAWDOWNS FOR SIAD PUMPAGE				
Depot Well Name	WESTEC No.	Land Surface (^a) (ft)	Observed Drawdown (ft)	Model Predicted Drawdown (ft)
PSW-02	45	4103	132-155 ^(b)	150
PSW-05	46	4120	188-215	140
PSW-08	48	4102	123-134	140
PSW-09	49	4130	218-325	160
SIAD A11	--	4020	55	45
SIAD 10	5	4021	35	28
SIAD 1	6	4011	26	9
SIAD 6	7	4000	17	< 10
SIAD 11	9	4006	20	< 10
^(a) Estimated from topographic maps.				
^(b) Range in drawdown resulting from water level measurements taken during pumping at variable rates over time period 1986-1988.				

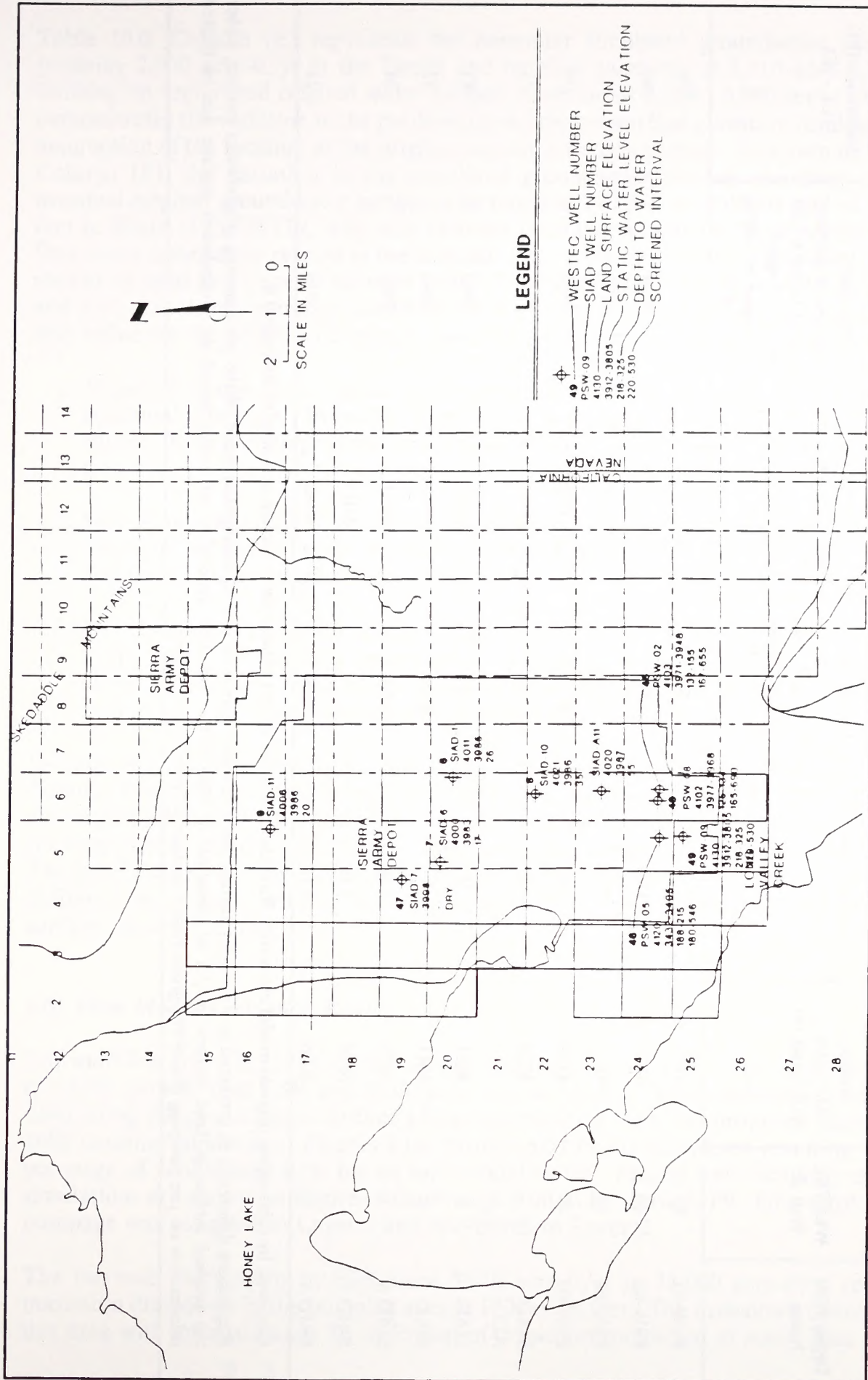


FIGURE 7.0
OBSERVED DRAWDOWN IN
SIERRA ARMY DEPOT WELLS

TABLE 10.0

GROUNDWATER SURFACE ELEVATION PREDICTION UNCERTAINTY AT SIAD

Depot Well Name	WESTEC Well #	(A) Land Surface Elevation at Well Head (Ft)	(B) Simulated Groundwater Drawdown (Ft)	(C) Simulated Groundwater Elevation Assuming Land Surface as Datum (Ft) (A)-(B)	(D) Measured Surface Elevation 1988 Assuming Land Surface as Datum (Ft)	(E)(1) Simulated Groundwater Surface Elevation Using USGS Model Original Groundwater Elevation (Ft)	(F) ⁽²⁾ Drawdown Difference (Ft) (C) - (E)
PSW-02	45	4103	150	3953	3948-3971	3835	118
PSW-05	46	4120	140	3980	3905-3932	3840	140
PSW-08	48	4102	150	3952	3968-3977	3835	117
PSW-09	49	4130	160	3970	3817-3912	3830	140
SIAD ALL	- -	4020	45	3975	3965	3920	55
SIAD 10	5	4021	28	3993	3986	3950	43
SIAD 1	6	4011	9	4002	3985	3965	37
SIAD 6	7	4000	<10	3990	3983	3966	24
SAID 7	- -	3998	<10	- -	DRY	- -	- -
SAID 11	9	4006	<10	3996	3986	3975	21

⁽¹⁾ Obtained by subtracting original model estimated drawdown from the model groundwater surface elevation of 3980-3990 ft.

⁽²⁾ Represents difference in predicted groundwater surface elevation from pumping due to assumption made of the pre-pumping groundwater surface, either the original surface at land surface and/or at elevation of 3980-3990. Indicates uncertainty of actual drawdown groundwater surface due to limited information on pre-pumping pre-1950's groundwater surface at Sierra Army Depot.

Table 10.0, Column (E) represents the computer simulated groundwater surface from pumping 2,000 acre-ft/yr at the Depot and baseline pumping of 5,910 acre-ft/yr at FSR utilizing an unpumped original water surface elevation of 3,980 - 3,990 feet. Column (F), demonstrates the variation in the predicted groundwater surface elevation resulting from the assumption of the location of the original unpumped water surface. As shown in Table 10.0, Column (F), the variation in the simulated groundwater surface elevation due to the assumed original groundwater surface is as much as 140 feet at PSW-05 and as little as 21 feet in SIAD 11 (WESTEC #9), with distance from the pumping wells lessening the effect. Due to the uncertainty related to the original surface, the predicted drawdowns at the Depot should be used as a general estimate only. The use of 2,000 acre-ft/yr will vary seasonally and with actual well pumpage schedules; it is a worst-case assumption. Other factors that may influence the ability to compare modeled drawdowns to measured drawdowns are:

1. *Model pumpage versus actual pumpage* - The model assumes 2,000 acre-ft/yr of continual pumpage. In reality, more water is pumped in the summer and less in the winter. Well pumping schedules vary and all wells do not pump continually at constant rates.
2. *Method of water level measurement in pumping wells* - Water level measurements are taken in individual wells at varying times before and after pumping. No static unpumped water levels are available for the area when all wells are turned off.
3. *Model well location versus actual well location* - Wells in the model must be assigned to the center of the mile square grids. In reality, wells are located off these center points. In addition, wells PSW-08 and PSW-02 were assigned as one well in model cell 24;6, resulting in over-predicting drawdowns at this location.

Because of these limitations, drawdown and groundwater surface elevation estimates at a distance from the well field pumping centers are considered more reliable. In both cases where groundwater is assumed near the surface, as well as when it is assumed to be below the land surface, the estimates of drawdown and groundwater surface improve with distance. The groundwater surface elevation at the Depot resulting from Depot pumpage cannot be definitely determined without more information on the original unpumped groundwater surface elevation in this area.

6.0 Flow Model Simulation Results

The modified grid was used to simulate the drawdown resulting from the proposed pumping of 13,000 acre-ft/yr at FSR and 2,000 acre-ft/yr at SIAD. The drawdown is calculated by subtracting the groundwater surface elevations resulting from the proposed pumping from 1988 baseline conditions. Figures 8.0a through 8.0d depict drawdown resulting from FSR pumpage of 13,000 acre-ft/yr for all four model layers. Project well locations used in the simulations are shown on Figures 8.0a through 8.0d as P1 through P9. One-third of project pumpage was assigned to Layer 1 and two-thirds to Layer 2.

The increase in pumping at FSR from 5,910 acre-ft/yr to 13,000 acre-ft/yr results in a maximum drawdown in the pumping area at FSR of 78 feet. The drawdown decreases from this area with approximately 50 to 55 feet of drawdown predicted at Astor Pass and 30 to

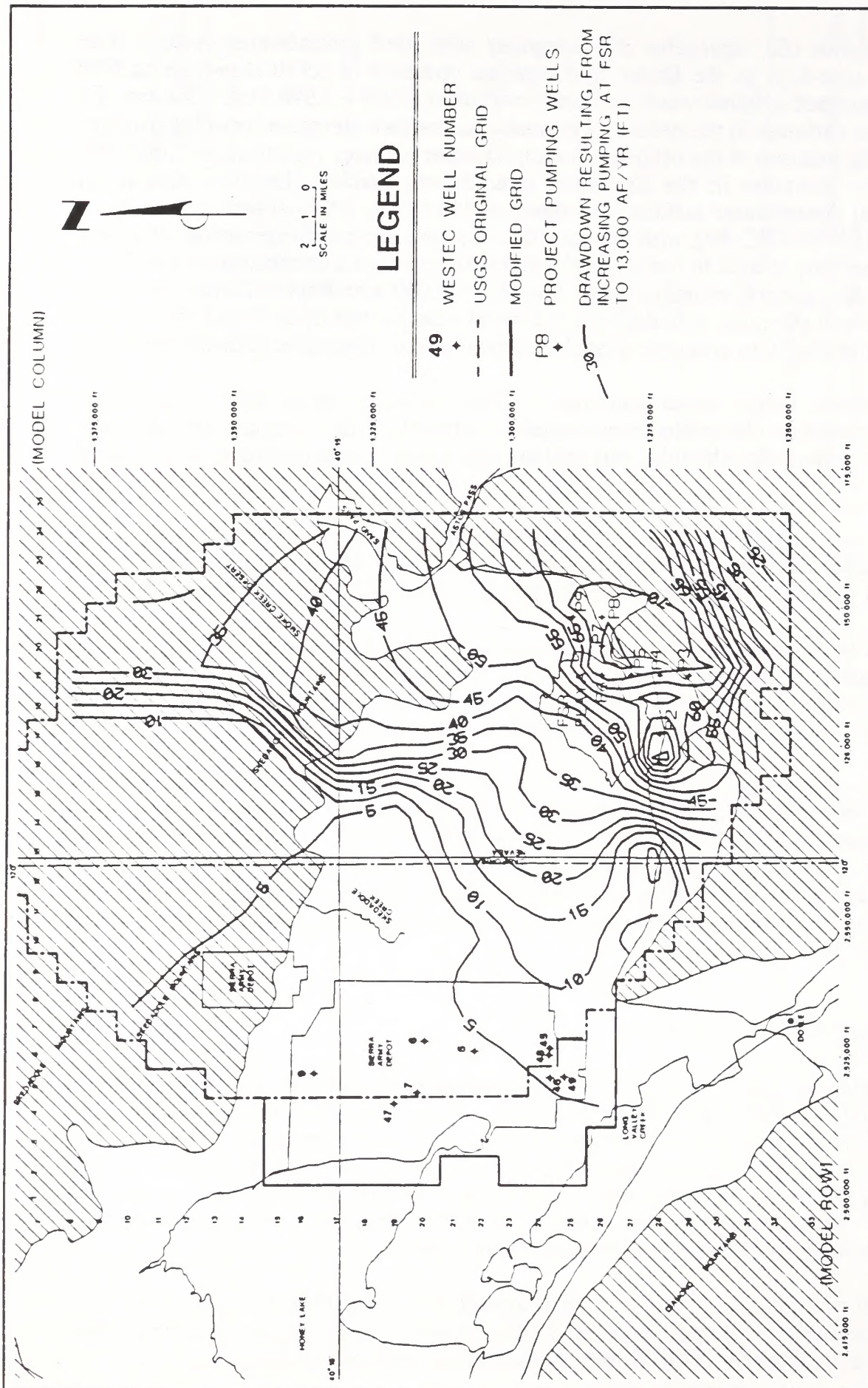


FIGURE 8.0a

DRAWDOWN RESULTING FROM INCREASED PUMPING

AT FSR TO 13,000 AF/YR LAYER 1

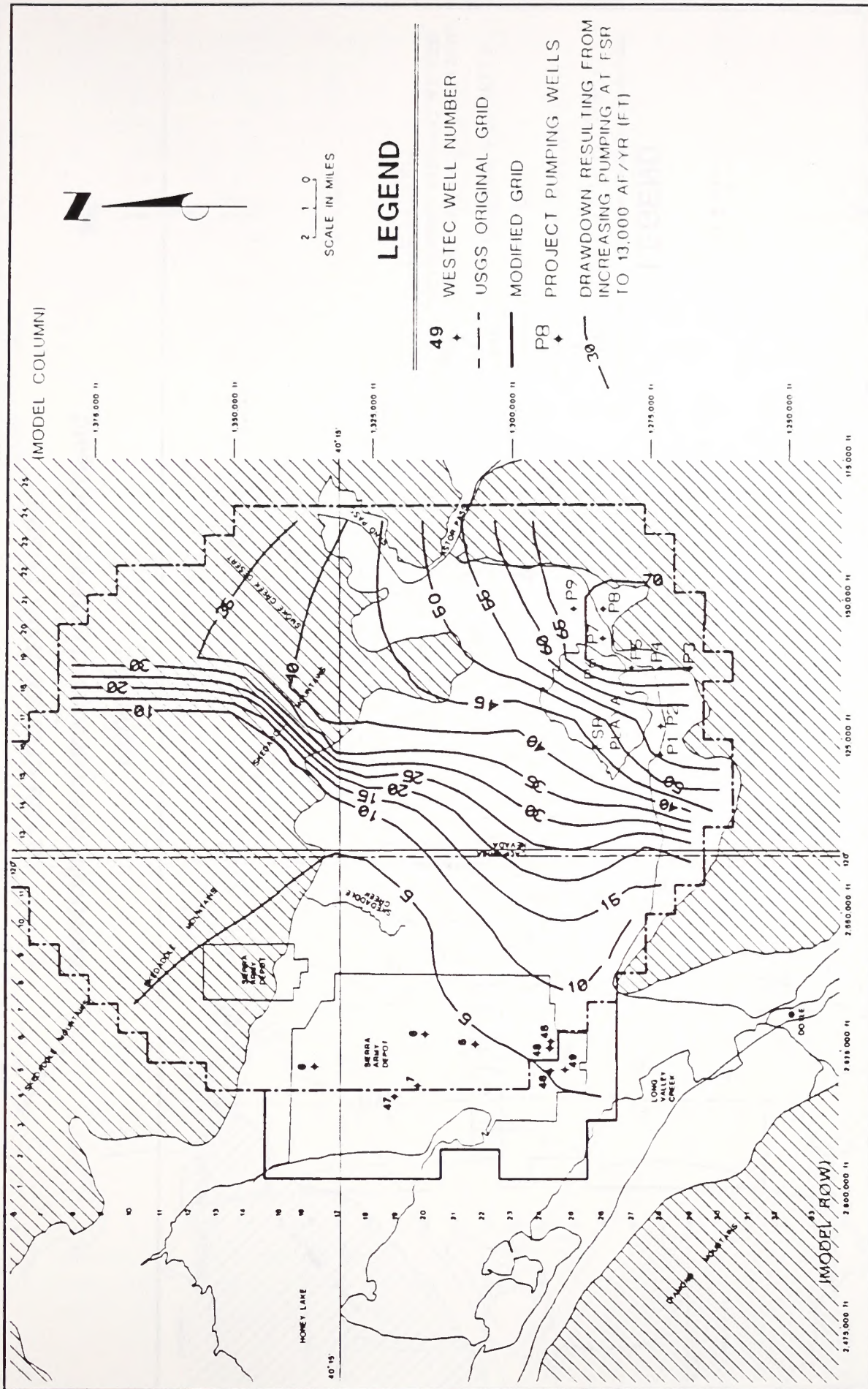
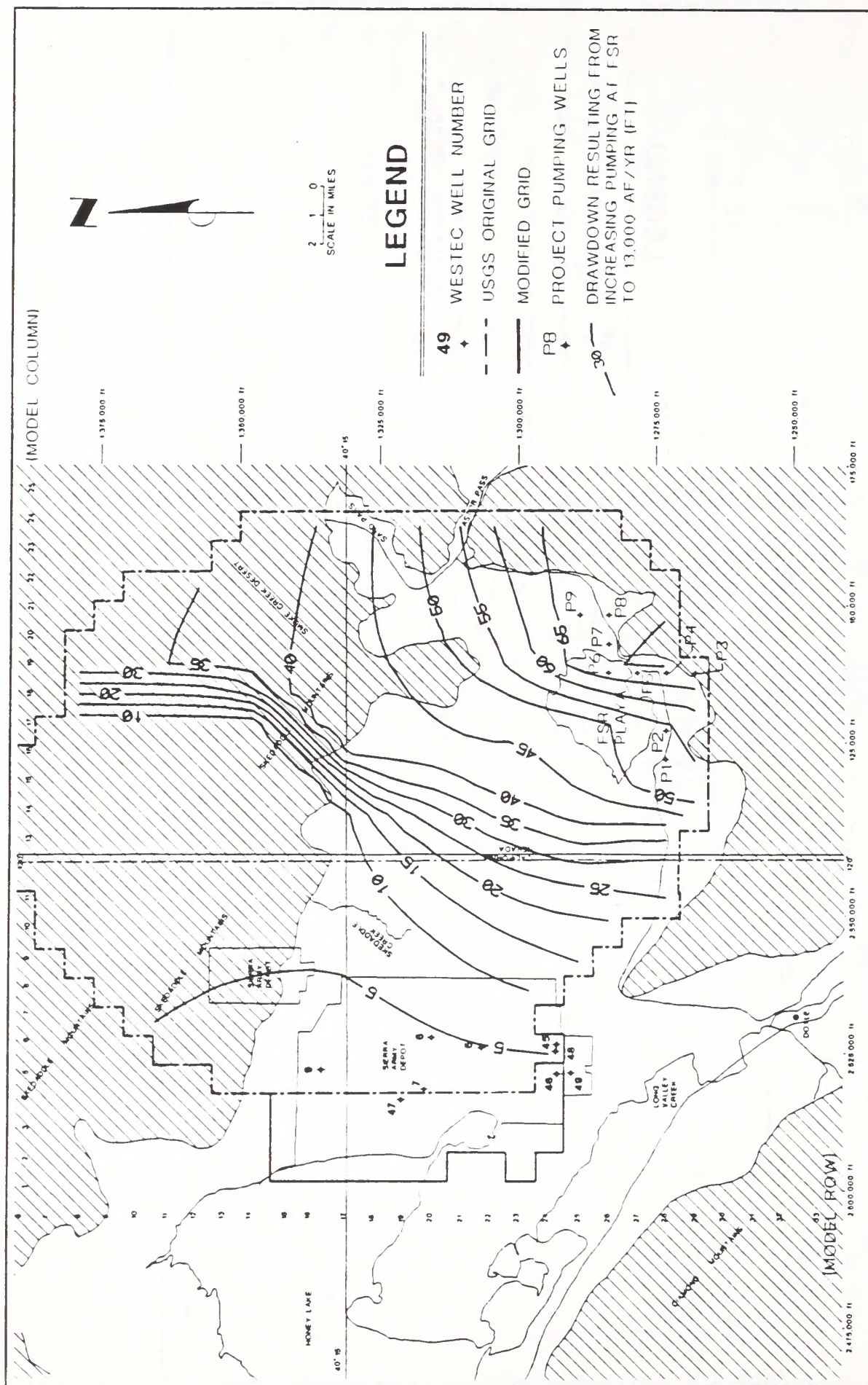


FIGURE 8.06
DRAWDOWN RESULTING FROM INCREASED PUMPING
AT FSR TO 13,000 AF/YR LAYER 2



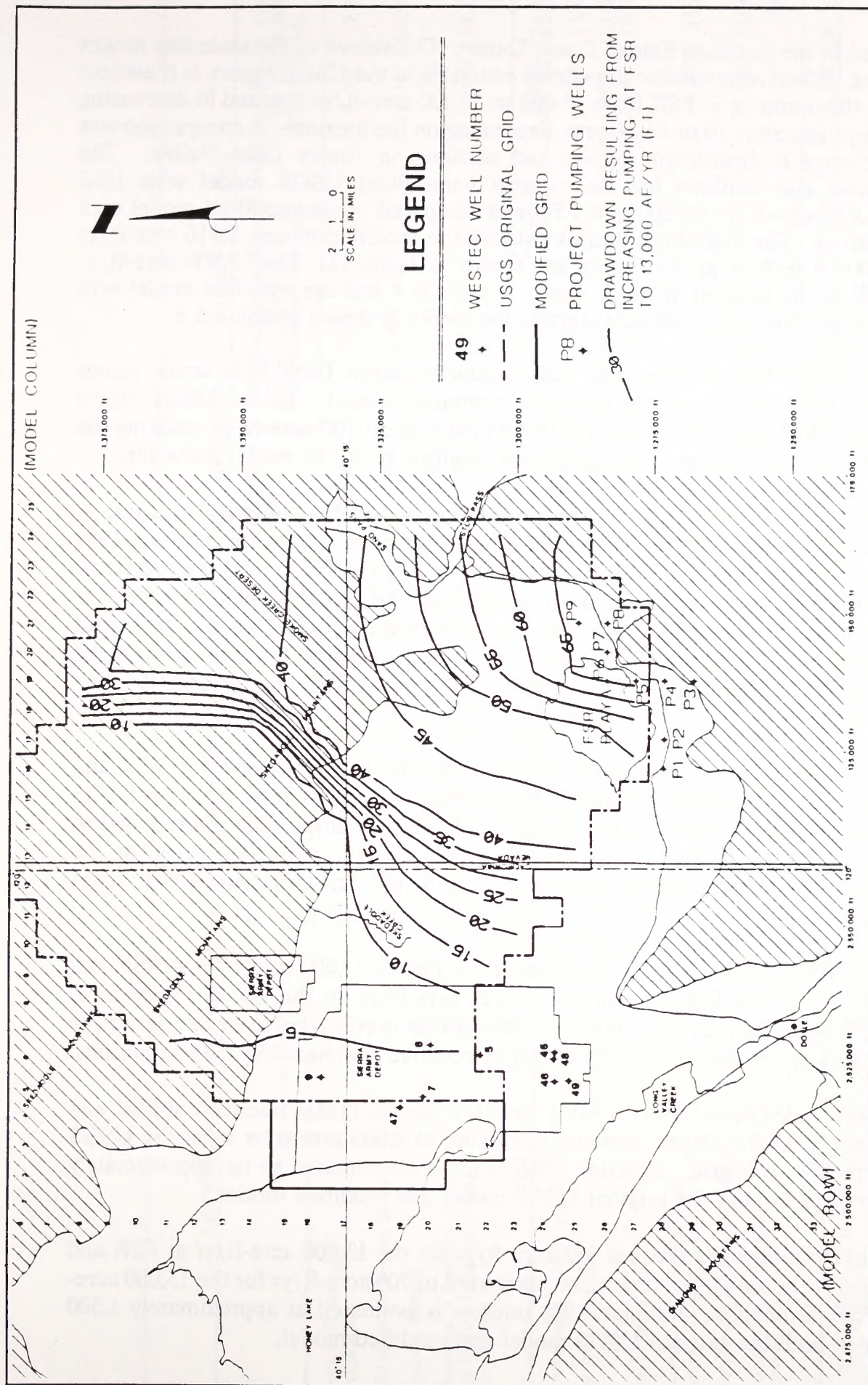


FIGURE 8.0d

DRAWDOWN RESULTING FROM INCREASED PUMPING

AT FSR TO 13,000 AF/YR LAYER 4

40 feet predicted in the southern Smoke Creek Desert. Drawdown at the state line ranges from 5 to 20 feet. When compared to drawdown estimates in the USGS report, it is evident that decreasing the pumping at FSR from 15,000 to 13,000 acre-ft/yr resulted in decreasing drawdown by approximately 10 to 40 percent, depending on the location. A comparison was made of the change in hydrologic inflows and outflows in Honey Lake Valley. The hydrologic inflows and outflows for the original unmodified USGS model with 1988 conditions of 5,910 acre-ft/yr pumping at FSR was compared to the modified model with the same conditions. The hydrologic budget data for the modified model, 5,910 acre-ft/yr at FSR and 2,000 acre-ft/yr at the Depot, are shown in Table 11. The 15,000 acre-ft/yr pumping at FSR in the original model is shown in column 4 and the modified model with 13,000 acre-ft/yr at FSR and 2,000 acre-ft/yr at the Depot is shown in column 5.

To allow direct comparison of hydrologic budget information in Table 11.0, actual values for each model input were extracted from the computer output. In the USGS report (Handman et al., 1990), values were rounded off to the nearest 100 acre-ft/yr, masking the small changes in recharge and evapotranspiration resulting from the model extension.

As indicated in Table 11.0, hydrologic inflows or recharge to the model remain the same as in the USGS model results for the future pumping scenario, as well as for baseline 1988 conditions with the exception of the Depot area. Due to the model extension, an additional 162 acre-ft/yr of areal precipitation was added to the modified model relative to the USGS model. The inclusion of Depot pumpage results in an increase of inflow toward the Depot from Honey Lake of 1,253 acre-ft/yr compared to a range of 580 to 660 acre-ft/yr in the USGS simulations. Hydrologic outflows varied from the USGS model and baseline conditions as follows:

1. Evapotranspiration decreases to 4,495 acre-ft/yr for the 13,000 acre-ft/yr at FSR and 2,000 acre-ft/yr at the Depot simulation, compared to 4,600 acre-ft/yr from the USGS 15,000 acre-ft/yr pumping scenario. Baseline 1988 evapotranspiration is simulated to be 10,804 acre-ft/yr by the USGS. Baseline 1988 evapotranspiration rates for the modified model are increased by 800 acre-ft/yr to 11,603 acre-ft/yr due to the model extension.
2. Outflow to Honey Lake decreases to 36 acre-ft/yr for the 13,000 acre-ft/yr at FSR and 2,000 acre-ft/yr at the Depot, compared to 420 acre-ft/yr for the USGS 15,000 acre-ft/yr at FSR pumping scenario. Baseline 1988 outflow is estimated to be 589 acre-ft/yr for the USGS model and 94 acre-ft/yr for the modified grid baseline 1988 conditions.
3. Outflow to Smoke Creek Desert is 3,041 acre-ft/yr for the 13,000 acre-ft/yr at FSR and 2,000 acre-ft/yr at the Depot scenario, compared to 2,000 acre-ft/yr from the USGS 15,000 acre-ft/yr scenario. Baseline 1988 outflow is estimated to be approximately 5,300 acre-ft/yr in both the original USGS model and modified model.
4. Outflow to Pyramid Lake Basin is 953 acre-ft/yr for the 13,000 acre-ft/yr at FSR and 2,000 acre-ft/yr at the Depot simulation compared to 700 acre-ft/yr for the 15,000 acre-ft/yr at FSR simulation. Baseline 1988 outflow is estimated at approximately 1,500 acre-ft/yr in both the original USGS model and modified model.

TABLE 11.0 GROUNDWATER BUDGETS FOR PROPOSED PUMPING COMPARED TO USGS RESULTS (ALL VALUES IN AF/YR)					
	Original Unmodified USGS 1988 Conditions ^(a) No Depot Pumpage	Modified Model 1988 Conditions No Depot Pumpage	Modified Model 1988 Conditions Depot Pumpage	Original Unmodified USGS 15,000 AF/YR at FSR No Depot Pumpage	Modified Model 13,000 AF/YR FSR 2,000 AF/YR Depot
Direct infiltration of precipitation	9,200 (9177) ^(b)	9,300 (9,339)	9,300 (9,339)	9,200	9,300 (9,339)
Infiltration of Stream Runoff	13,000 (12,829)	13,000 (12,829)	13,000 (12,829)	13,000	13,000 (12,829)
Irrigation Return	1,500 (1,479)	1,500 (1,479)	1,500 (1,479)	0	0
Groundwater Inflow to Model from Honey Lake and Long Valley Creek	580 (577)	730 (725)	1,250 (1,253)	660	1,330 (1,331)
TOTAL	24,000 (24,062)	25,000 (24,372)	25,000 (24,900)	23,000 (22,860)	23,630 (23,499)
Groundwater Evapotranspiration	11,000 (10,804)	12,000 (11,603)	10,000 (10,185)	4,600	4,500 (4,495)
Well Withdrawals	5,910 FSR (5,914)	5,910 FSR (5,914)	5,900 FSR 2,000 Depot (1,996)	15,000 FSR	13,000 FSR (12,983) 2,000 Depot (1,996)
Number of Wells	(5)	(5)	(8)	(18)	(13)
Groundwater Outflow from Model to Honey Lake	590 (589)	100 (94)	60 (61.9)	420	40 (36.8)
Groundwater Outflow to SCD	5,300 (5,287)	5,300 (5,288)	5,300 (5,273)	2,000	3,000 (3,041)
Groundwater Outflow to Pyramid Lake	1,500 (1,468)	1,500 (1,468)	1,500 (1,466)	700	1,000 (953)
TOTAL	24,000 (24,062)	25,000 (24,367)	25,000 (24,897)	23,000 (22,720)	23,500 (23,505)
^(a) Excepted from Water Resources Investigation Report No. 90-4050.					
^(b) Values in parenthesis are actual model estimates. USGS numbers may vary slightly, from original report due to roundoff performed by Gateway 486 P.C.					

To evaluate the relative impacts on water level at the SIAD from the increase in pumping at FSR, the RMSD of predicted heads for the model simulations for the 13,000 acre-ft/yr pumping at FSR and 2,000 acre-ft/yr pumping at the Depot was compared to 5,910 acre-ft/yr at FSR and 2,000 acre-ft/yr at the Depot. The RMSD areas used to estimate the head differences are shown on Figure 4.0. Table 12.0 summarizes the results of these comparisons. Table 12.0 shows the RMSD in heads for all model layers at the Depot from increasing FSR pumping to 13,000 acre-ft/yr compared to 1988 baseline FSR pumpage of 5,910 acre-ft/yr. As indicated in Table 12.0, the change in water levels at the SIAD resulting from the increase in pumping at FSR averages 7 feet in Layers 1 and 2, and 10 to 12 feet in Layers 3 and 4, indicating FSR pumpage has a minor influence at the Depot at steady state conditions. This is also demonstrated by the drawdown maps (Figures 8.0a through 8.0d) which indicate the influence on water level at the Depot from the increase in FSR pumping is generally less than 10 feet and over much of the Depot area averages 5 feet or less.

TABLE 12.0				
RMSD IN HEADS RESULTING FROM INCREASING FSR PUMPING TO 13,000 ACRE-FT/YR				
	Entire Grid	Depot	FSR	Eastern Boundary
L1	32	7.0	55.8	42
L2	32	7.6	57.8	43
L3	33	10.3	58.3	45
L4	33	12.6	58.1	46

6.1 Storativity and Time to Reach Steady State

Storativity is the volume of water that a permeable unit will absorb or expel from storage per unit surface area per unit change in head. In an unconfined aquifer, such as the shallow groundwater aquifer in Honey Lake Valley, the storativity value is equal to the specific yield. Specific yield of the aquifer can be used to estimate the time between when pumping begins and equilibrium groundwater conditions are reached. The USGS model and modified USGS model did not consider storativity due to limited data. Computer simulations were performed assuming the time to reach equilibrium groundwater conditions was instantaneous. To obtain some general estimate of the time to reach equilibrium groundwater conditions after pumping begins, an analytical solution method was used, as follows:

Annual Pumpage = Storage depletion rate + rate of discharge capture

$$Q = \frac{S.D.}{t} + \frac{P.Y.}{2}$$

(Rush and Glancy, 1967)

where Q = annual pumping rate in acre-ft/yr
 S.D. = storage depletion in acre-feet
 t = time required to reach steady state conditions in years
 P.Y. = perennial yield

Considering that the annual pumping rate estimated for the future pumping scenario of 15,000 acre-ft/yr is equal to the perennial yield of the aquifer, estimated by Handman et.al at (1990) at 15,000 acre-ft/yr the following equation:

$$Q = \frac{S.D.}{t} + \frac{Q}{2}$$

reduces to:

$$\frac{Q}{2} = \frac{S.D.}{t}$$

or

$$t = \frac{2(S.D.)}{Q}$$

To calculate the storage depletion (S.D.) that takes place between 1988 and the time of future proposed steady state conditions, the volume of aquifer that is dewatered between 1988 conditions and the future steady state conditions was calculated. This volume of aquifer (V_{aquifer}) is 6,455,071 acre-feet.

Assume that specific yield (S_y) = .1 (Rush and Glancy, 1967)

then $S.D. = (S_y) V_{\text{aquifer}} = (.1)(6,455,071) = 645,507$ acre-feet

Plugging this value into the equation for t gives the time required to reach steady state conditions.

$$t = \frac{2(645,507 \text{ acre-feet})}{13,000 \text{ acre-ft/yr at FSR and } 2,000 \text{ acre-ft/yr at Depot}}$$

$t(\text{time to reach equilibrium}) = 86 \text{ years.}$

7.0 Subsidence

Decreasing groundwater levels from the original elevation to some predicted level can result in land subsidence. To evaluate the potential for subsidence the predicted groundwater elevations resulting from pumping 13,000 acre-ft/yr at FSR were used to perform a subsidence analysis. The analysis consisted of a review of geologic information, development of assumptions concerning various soil properties, calculation of hydrostatic pressure changes, and estimation of resulting potential for soil compaction.

The project area was evaluated assuming two different foundation soil types: silty sand and clay. This variation in soil type was assumed based on the USGS model and well log data; it was not based on detailed geotechnical boring data or soil sample laboratory test data. Values for void ratio, unit weight, compression index and Young's modulus were assumed as needed for each foundation soil type. The consolidation calculations were terminated at a depth below the final groundwater elevations where changes in the effective overburden pressure due to groundwater drawdown resulted in minimal additional consolidation of the foundation soil. After reviewing existing data, the depth of compressible material (alluvium) was assumed to be semi-infinite in the project area to provide a worst-case analysis.

Bedrock located at the valley margins is incompressible and will not subside. The alluvial/bedrock interface was assumed to represent the outer edge of subsidence. Areas underlain by volcanic rocks were assumed incompressible.

Calculations of Subsidence for Silty Sands

Due to the potential for sands to settle immediately and over a period of time calculations were performed to determine both immediate and gradual settlement for silty sands. The following geotechnical properties were assumed from typical values assigned to generic soil types and assigned to the silty sand foundation soil:

void ratio = 0.65 (Das, 1990) dimensionless
 compression index = 0.04 (McCarthy, 1982) dimensionless
 unit weight = 110 pounds per cubic foot (pcf)

Consolidation settlement was evaluated using the following equation.

where:

$$\Delta H = \frac{C_c}{1+e_o} H_i \log \left(\frac{P+\Delta P}{P} \right) \quad (\text{McCarthy, 1982})$$

ΔH =
 consolidation (feet)

C_c = compression index (dimensionless)

e_o = void ratio (dimensionless)

P = existing effective overburden pressure (psf) at the layer midheight

ΔP = change in effective overburden pressure (psf) at the layer midheight

H_i = initial layer height (feet)

Immediate settlement was evaluated using the following equation:

$$\Delta H = \Delta \Sigma (H_1)$$

where:

ΔH = settlement (feet)

$\Delta \Sigma$ = strain change at the layer midheight

H_1 = initial layer height

Based upon the assumptions made, the results indicate a range of settlement for silty sand over the project area between 30 inches and 54 inches within approximately 2 miles of the well locations. For areas located at distances greater than 2 miles from the well locations to the valley margin, the range of settlement varied between 3 inches and 30 inches. The estimated average settlement is approximately 14 inches.

Calculations of Subsidence for Clay

Potential settlement across the project area was then evaluated assuming a foundation soil composed of clay. Since clays are primarily subject to consolidation associated with dissipation of excess pore pressure over time, calculations were performed to determine consolidation settlement only. The following geotechnical properties were assumed based on literature and assigned to the clay foundation soil:

void ratio = 0.8 (Das, 1990) dimensionless
compression index = 0.3 (Das, 1990) dimensionless
unit weight = 110 pounds per cubic foot

Consolidation settlement was evaluated using the same equation as previously listed.

Immediate settlement was assumed to be negligible.

Based upon the assumptions made, the results indicate a range of settlement for clay over the project area of between 103 inches and 162 inches in the area within approximately 2 miles of the well locations. For areas located at distances greater than 2 miles from the well locations to the valley margin where bedrock occurs, the range of settlement varied between 28 inches and 112 inches. The estimated average settlement is approximately 70 inches.

Subsidence decreases logarithmically from the pumping centers. As a result, the potential for differential settlement decreases rapidly outside the 2-mile radius. At the Sierra Army Depot, 5 feet of drawdown is predicted from the model simulations due to FSR pumpage. The hydraulic gradient will be very flat with a change of 3 feet for every 10,000 linear feet. Subsidence is estimated at 5 inches and, due to the flat topographic gradient, virtually no differential settlement is predicted. At the western and southwestern extent of the model, drawdown of the water table is predicted to be 2 feet or less. Seasonal groundwater fluctuations in this area are greater than 2 feet and do not result in subsidence. Subsidence is therefore not expected in these areas.

The ranges in subsidence noted above are based on assumed soil properties and not field-verified testing. The project area is underlain by interbedded lenses of sands and clay as described in original well logs from the project area. As a result, the actual settlement should lie between the values noted based upon the assumptions made. Differential settlement is a concern in the area of the wells since this area will experience the greatest variation in groundwater elevations and depth to bedrock over the shortest distance and therefore has the greatest potential for differential settlement. Depending upon the composition of the foundation material, the time required for dissipation of excess pore pressures could vary significantly (days to years). As a result, further geotechnical analysis may be necessary depending on projected future land use in areas where significant settlement is expected.

7.1 Storage Loss from Subsidence

The subsidence at the project site will cause a reduction in the groundwater storage capacity of the aquifer. This reduction will be due to a decrease in initial void ratio of the soils associated with an increase in the net applied pressure felt by the soils due to subsidence. Based upon the assumed values for void ratio and upon other assumptions made as noted previously, the volume of groundwater storage lost as a result of subsidence could range from approximately 0.3 percent to 5.1 percent of the initial storage capacity available in the foundation soils for the upper 1,000 feet of the aquifer. Below 1,000 feet, compaction and storage capacity loss due to subsidence is assumed to be minimal. In particular, an approximate average 0.3 percent of storage capacity (approximately 4.41×10^8 gallons or 1,352 acre-feet) may be lost where 2 inches to 15 inches of subsidence is estimated. Where 16 inches to 66 inches and 67 inches to 108 inches of subsidence is estimated, approximately 2.1 percent (approximately 1.3×10^9 gallons or 3,988 acre-feet) and 5.1 percent (approximately 1.4×10^9 gallons or 4,294 acre-feet), respectively, of storage capacity may be lost due to subsidence. It is important to note that these estimates are based upon geotechnical assumptions due to a lack of site-specific geotechnical information, and the actual values could vary significantly from those calculated.

The time required to produce the ultimate subsidence values noted above will depend upon the type of soil present at the site. Since site-specific geotechnical information is not available, values for the coefficient of consolidation were assumed for both silty sand and clay foundation soils. For silty sands, a value of 3×10^{-7} ft²/sec was assumed, while a value of 3×10^{-8} ft²/sec was assumed for clay soils. In addition, single drainage of the foundation soils was assumed since the site is ultimately underlain by a bedrock material which is assumed to act as an impermeable barrier. Since the time required to reach 100 percent consolidation is infinite, the following equation was used to estimate time required to reach 90 percent consolidation of the foundation soils:

$$T_{90} = \frac{C_v t_{90}}{H}$$

Where:

- T_{90} = Time Factor for 90 percent consolidation (dimensionless)
- t_{90} = Time required to reach 90 percent consolidation (seconds)
- H = Single drainage layer depth (feet)
- C_v = Coefficient of consolidation (FT²/Sec)

Based upon the assumptions made, approximately 87 to 870 years will be required to reach 90 percent consolidation of the silty sand and clay foundation soils, respectively, due to subsidence. Since the site appears to be interbedded layers of silty sand and clay, the actual time required to reach 90 percent consolidation of the foundation soils due to subsidence should be in between the two values noted above, perhaps several hundred years.

Fissuring has been observed approximately 7 miles north of the FSR area between FSR playa and Flanigan. The cause of the fissuring is not known but may be related to fault movement, desiccation cracks, or FSR pumping.

8.0 Environmental Impact Analysis

The results of the flow modeling and predicted drawdowns were used to address the potential environmental impacts identified in Section 2.1. Each area of concern is discussed in the sections that follow.

8.1 Well User Impact

Potential environmental impacts to well users related to groundwater flow conditions in Honey Lake Valley have been identified as:

- Access to water supply.
- Lowering groundwater levels in existing wells.

The model predicts drawdowns ranging from 10 to 70 feet throughout most of Honey Lake Valley. The majority of the drawdown occurs east of the California-Nevada state line. Existing well users in this area may experience lowered water levels in their wells over the life of the project when groundwater equilibrium conditions are met. The result of lowered groundwater levels may be increased pumping costs and the potential for shallow domestic wells to go dry. Access to water at current groundwater levels will be denied and deeper wells will need to be drilled in these areas to obtain water.

8.2 Subsidence

The range in subsidence is estimated to be 3.0 to 162 inches depending on the soil type and location, with the maximum amount of subsidence occurring at project wells. The potential impact from subsidence may require the design of structures near wellheads for differential settlement. The amount of subsidence predicted is not expected to substantially reduce aquifer storage from compaction with estimates of storage loss varying from 0.3 to 5.1 percent of the total storage capacity of the upper 1,000 feet of the aquifer, depending on the soil type.

8.3 Basin Outflow

8.3.1 Honey Lake Valley to Pyramid Lake Basin and Smoke Creek Desert

Basin outflows to Pyramid Lake Basin and Smoke Creek Desert are estimated by the USGS to be 1,500 acre-ft/yr and 5,300 acre-ft/yr, respectively, under steady state 1988 pumping. Increasing the pumping at FSR to 13,000 acre-ft/yr results in a decrease of outflow of 547 acre-ft/yr and 2,259 acre-ft/yr to Pyramid Lake and Smoke Creek Desert, respectively. Decreasing outflows to these areas could impact Smoke Creek Desert and Pyramid Lake Basin if water quality is degraded due to reduced flows or if water quantity is substantially reduced.

8.3.2 *Smoke Creek Desert to Pyramid Lake Basin*

Underflow may occur between Smoke Creek Desert and Pyramid Lake Basin. Assuming underflow does occur, reductions in underflow to Smoke Creek Desert from Honey Lake of 2,259 acre-ft/yr may also affect flows between Smoke Creek Desert and Pyramid Lake Basin. To evaluate this potential impact, an analysis was made to estimate baseline flows between Smoke Creek Desert and Pyramid Lake and the possible reduction in these baseline flows due to project pumping at FSR. As the area between Smoke Creek Desert and Pyramid Lake Basin was not included on the computer model, analytical solutions using two dimensional flow equations were used.

Glancy and Rush (1968, p. 27) provide an equation for calculation of underflow from valleys:

$$q = (.00112) T (dH/dL) W \quad (1)$$

Where

q = quantity of flow (acre-ft/yr)

T = transmissivity (gallons/day/foot)

dH/dL = hydraulic gradient (ft/mile)

W = width of underflow section (miles)

.00112 = conversion factor for gallons/day to acre-ft/yr

Equation 1 is derived from Darcy's Law:

$$q = -KA(dH/dL)(2)$$

Where

K = hydraulic conductivity

A = area

b = aquifer thickness

$A = bW$

$T = Kb$

Baseline flows from Smoke Creek Desert were estimated assuming:

- (1) The range of transmissivity values from field testing and model output at Sand Pass and Astor Pass are similar to the range of values that would be found in the Terraced Hills between the Smoke Creek Desert and Pyramid Lake Basin. At Sand Pass, the screened interval in the well is in basaltic lava flows interbedded with volcanic gravels and/or cinders. At Astor Pass, the screened interval is in basaltic lava flows.

Field transmissivity values at Sand Pass:

$$T_{\min} = 85,700 \text{ gpd/ft}$$

$$T_{\max} = 101,000 \text{ gpd/ft}$$

Model transmissivity values at Sand Pass:

$$T = 35,687 \text{ gpd/ft}$$

Field transmissivity values at Astor Pass:

$$T_{\min} = 30,000 \text{ gpd/ft}$$

$$T_{\max} = 47,500 \text{ gpd/ft}$$

Model transmissivity values at Astor Pass:

$$T = 31,842 \text{ gpd/ft}$$

(The average of these transmissivity values is 55,288 gpd/ft)

- (2) The changes in water levels predicted by the model at the Smoke Creek Desert general head boundaries represent the maximum effects in Smoke Creek Desert of increased groundwater pumpage in Honey Lake Valley. The actual change in water levels may be substantially less than the change predicted by the model at the general head boundaries because phreatophytes may be lost due to the lowered water table and evapotranspiration may be subsequently reduced. The average predicted change in groundwater levels at the general head boundaries is 29 ft (Table 2.0). In order to model the potentially smaller head changes resulting from loss of phreatophytes, provide a worst case scenario, and a probable range in flow from Smoke Creek Desert to Pyramid Lake Basin, calculations were made using 10, 20 and 30 ft. declines in groundwater levels in the Smoke Creek Desert.
- (3) The future water level in Pyramid Lake will be maintained to protect the endangered cui-ui. The water level in Pyramid Lake has been affected by water diversions since 1908 when Derby Dam and the Truckee Canal were built and Truckee River water was diverted to the Newlands Project in Fallon. Before the Newlands diversion, the elevation of Pyramid Lake was approximately the same as the surface elevation in Smoke Creek Desert (1891 lake elevation = 3877.9 ft, approximate elevation of the floor of Smoke Creek Desert = 3850 ft). The similarity in groundwater surface elevation in Smoke Creek Desert and Pyramid Lake Basin suggests that there may have been no flow or the groundwater flow gradient may have been toward Smoke Creek Desert from Pyramid Lake Basin, although no pre-1908 groundwater data are available to verify this. The elevation of Pyramid Lake is used to calculate the hydraulic gradient component of underflow using Equation 1. The most recent Pyramid Lake level is 3801 feet for 1991 from Water Resources Data, Nevada, Water Year 1991 (Garcia et al., 1992). This lake level is used to estimate the hydraulic gradient and resulting flow from Smoke Creek Desert to Pyramid Lake Basin.
- (4) The width of the underflow section is six miles (estimated width of the Terraced Hills).

Underflow between Smoke Creek Desert and Pyramid Lake Basin was be estimated using the hydraulic gradient between Soda Springs in Smoke Creek Desert and Pyramid Lake. Due to the lack of data on the altitude of the water table beneath the south end of Smoke Creek Desert, the elevation of Soda Springs was used in baseline calculations because it provides a surveyed groundwater level. Soda Springs is located at the south end of Smoke Creek Desert close to Pyramid Lake Basin, and its elevation is 3,881 ft. The distance from Soda Springs to Pyramid Lake is estimated to be 8.5 miles.

Baseline flow from Smoke Creek Desert to Pyramid Lake Basin can be estimated utilizing Equation 1. The hydraulic gradient is estimated using Soda Springs groundwater elevation data, 1991 Pyramid Lake water level of 3801 ft., and a distance of 8.5 miles as follows:

$$dH/dL = (3881-3801)/8.5 = 9.41 \text{ ft/mile}$$

The hydraulic gradient estimate is incorporated into Equation 1 to obtain the baseline flow from Smoke Creek Desert to Pyramid Lake Basin. This estimate is sensitive to the value assumed for transmissivity. Baseline flow from Smoke Creek Desert to Pyramid Lake Basin for a hydraulic gradient of 9.41 ft/mile and the range of transmissivity estimates discussed previously, for Astor and Sand Passes, ranges from 1,897 to 6,387 acre-ft/yr.

To predict the potential reduction in underflow from Smoke Creek Desert to Pyramid Lake Basin due to pumping at Fish Springs Ranch, an additional set of calculations was performed varying the hydraulic gradient. This variation ranges from a decrease of 10 to 30 feet in groundwater levels predicted by the model in Smoke Creek Desert and is applied at Soda Springs as follows:

10 ft. groundwater decline at Soda Springs, Pyramid Lake at 3801 ft.:

$$dH/dL = (3871-3801)/8.5 = 8.24$$

20 ft. groundwater decline at Soda Springs, Pyramid Lake at 3801 ft.:

$$dH/dL = (3861-3801)/8.5 = 7.06$$

30 ft. groundwater decline at Soda Springs, Pyramid Lake at 3801 ft.:

$$dH/dL = (3851-3801)/8.5 = 5.88$$

Equation 1 was solved using the range of transmissivity values at Astor Pass and Sand Pass, and using the gradient values of 8.24, 7.06, 5.88 calculated above to provide information on the potential range in baseline and future underflow estimates. The calculated flow rates for the different gradients and transmissivities range from 1,185 to 5,593 acre-ft/yr. The estimate of 2623 acre-ft/yr is considered to represent an approximate average value of annual flow to Pyramid Lake Basin based on a 20 foot reduction in groundwater elevation in Smoke Creek Desert. The potential reduction in flow resulting from the additional groundwater pumping in Honey Lake Valley using the average transmissivity and gradient conditions is 873 acre-ft/yr.

9.0 Water Quality Model

To evaluate the potential water quality impacts associated with the proposed pumping, a water quality model was developed. The model was used to predict water quality changes in Honey Lake Valley. The following steps were performed to develop the water quality model and evaluate TDS impacts from project pumping:

1. Water quality data review and validation. (Section 9.1)
2. Selection of total dissolved solids (TDS) as an appropriate indicator of water quality for modeling and construction of a TDS distribution map of Honey Lake Valley. (Section 9.2)
3. Selection of the MT3D three-dimensional water quality model and incorporation of fluxes from the modified USGS flow model directly into the MT3D model. (Section 9.3)
4. Model calibration. (Section 9.4)
5. Sensitivity analysis. (Section 9.5)
6. Model TDS migration simulation. (Section 9.6)

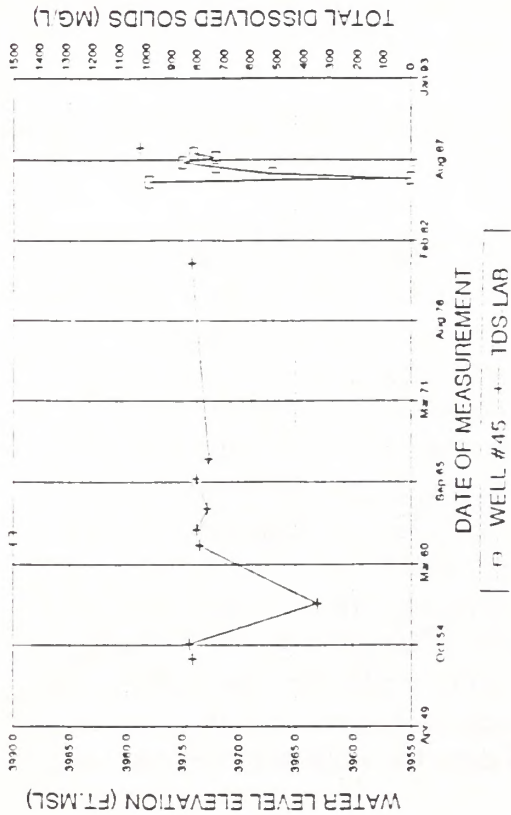
9.1 Water Quality Data Review and Validation

To evaluate the best approach for analyzing these impacts existing water quality data were reviewed. The primary data sources were:

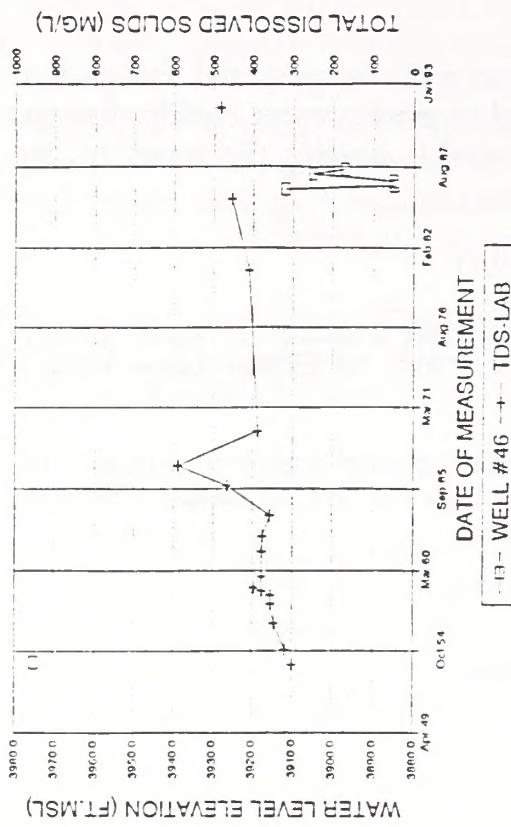
1. Washoe County water quality data.
2. Water quality data from published reports.
3. California DWR data.

The results of this review indicated that a large amount of TDS data were available. A TDS database used in the modeling effort is available from the BLM. TDS is an indicator of overall water quality and is a measurement of the total anions and cations in solution. This parameter was selected to be used as an indicator of overall water quality in the modeling analysis due to its direct correlation to water quality, the long record available at many wells and the ubiquity and distribution of data. An extensive data review and validation process was performed to ensure that the most reliable TDS data were used for the modeling effort. The record of TDS varies throughout the valley with some TDS well data from the early 1950s. A total of 110 wells have some TDS data associated with them. A large amount of TDS data were obtained as a result of more recent well sampling efforts in the late 1980s. TDS graphs for key wells in the valley are shown on Figures 9.0a and 9.0b. Well locations are shown on Figure 2.0. Figure 9.0a and 9.0b contains TDS graphs for the SIAD wells, which indicate fairly constant TDS concentrations over time with some possible increases in TDS in wells #45 and #46 in the last few years. TDS data for wells #18 (Ferrel well),

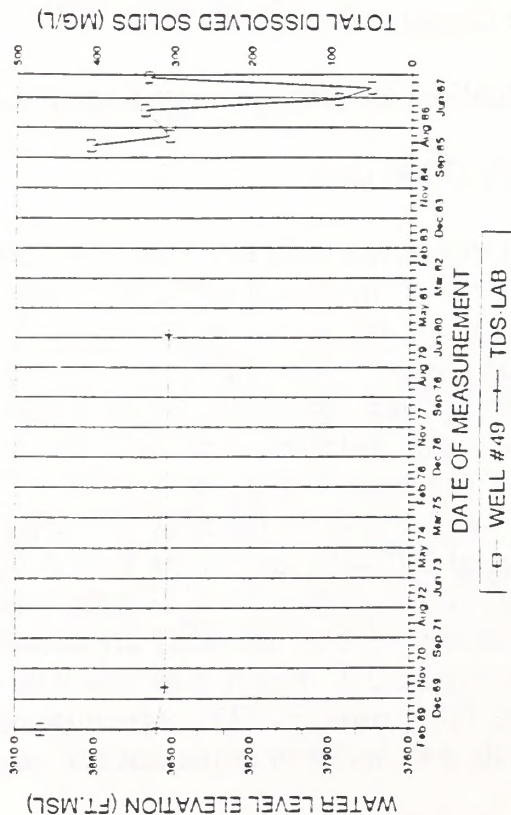
WELL #45 (SIAD PSW-02)



WELL #46 (SIAD PSW-05)



WELL #49 (SIAD PSW-09)



WELL #6 (SIAD WELL #1)

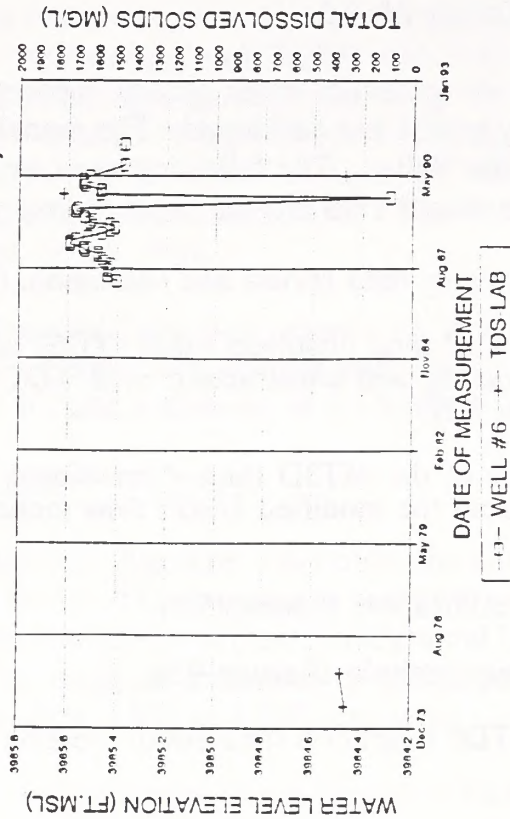
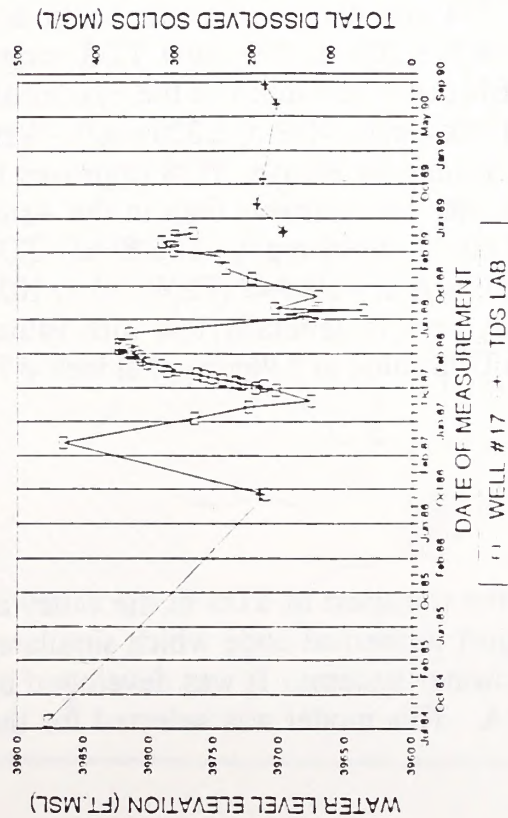
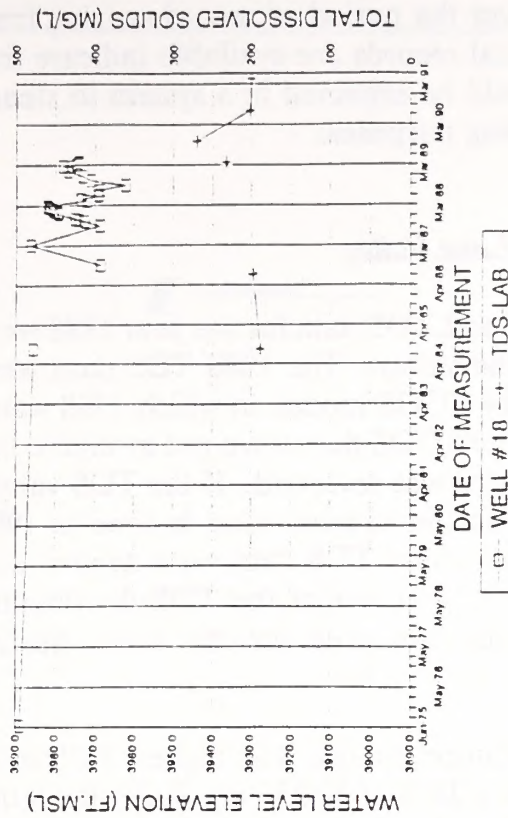


FIGURE 9.0a
TDS GRAPHS

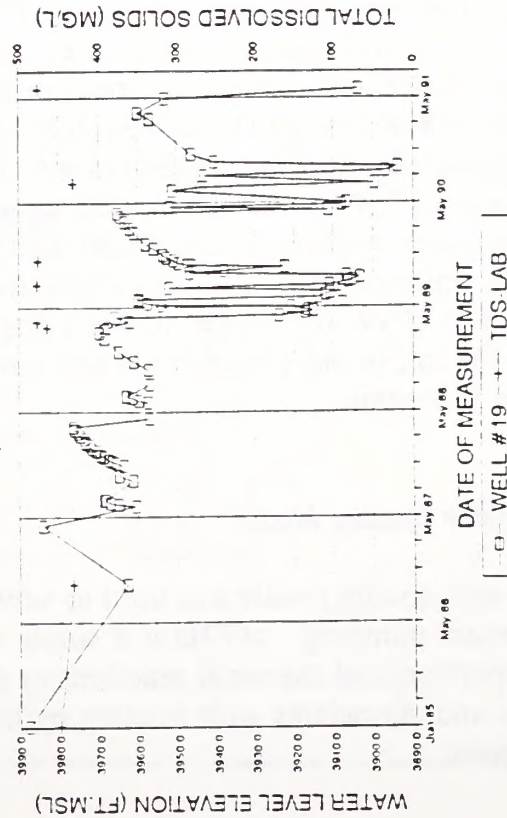
WELL #17 (JARBOE WELL)



WELL #18 (FERRELL WELL)



WELL #19 (WILSON WELL)



WELL #24 (HODGES WELL)

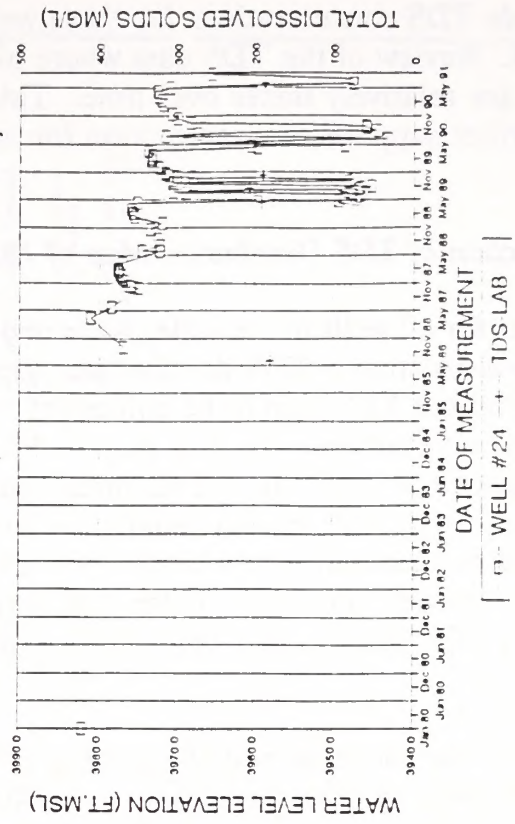


FIGURE 9.0b
TDS GRAPHS

#19 (Wilson well), #20 (Headquarters well), and well #17 (Jarboe well) in the FSR area indicate stable TDS concentrations for these wells over the period of record ranging from 1985 to 1991. Review of the TDS data where historical records are available indicate that TDS values are relatively stable over time. This would be expected in a system in steady state and further supports this assumption for modeling purposes.

9.2 Construction of TDS Distribution Map of Honey Lake Valley

The TDS data for all wells in the valley were reviewed and TDS data for the year 1988 were selected in constructing a TDS distribution map of the valley. The 1988 TDS data were used to develop the TDS map to be consistent with the USGS model, in which 1988 water levels were used to calibrate the flow model. Where 1988 TDS data were not available but other TDS data were available, the historical data record was reviewed. If the TDS values were consistent over time, as was usually the case, then the nearest value in time to 1988 that appeared representative was used. In a few cases where TDS data were needed and only limited data were available, these data were used to construct the TDS distribution map. Figure 10.0 depicts the 1988 TDS distribution map used for the water quality modeling.

The 1988 TDS map shows several areas of high TDS concentrations. The highest TDS zone is located northwest of FSR playa near well #78, with a TDS of 50,259 mg/l. Wells in the vicinity of well #78 also contain high TDS waters such as 8,140 mg/l at well #23 and 1,089 and 751 mg/l at wells #106 and #107. Well TDS data directly south of these wells indicate the high TDS area is bordered by good quality water as shown in wells #60, #61 and #58 with TDS values ranging from 201 to 321 mg/l. With the exception of well #112 (Nork well) and #19 (Wilson well), which contain TDS at 734 and 464 mg/l, wells south and southwest to FSR playa contain good water quality in the 200 to 300 mg/l TDS range. There are limited data on TDS in the area north of FSR playa and south of the Skedaddle Mountains. Well #98 located south of High Rock well has a high TDS of 3,220 mg/l. West of well #98 along the northern valley margin of the Skedaddle Range, TDS improves to values ranging from 158 to 289 mg/l. TDS concentrations are relatively high in the Astor and Sand Pass areas with most values ranging from 1,600 to 2,500 mg/l. The SIAD TDS is variable with water-supply-well TDS ranging from 290 mg/l at well #49 (PSW-09) to 1020 mg/l at well #45 (PSW-02). TDS in the Long Valley area is generally low with values ranging from 136 to 249 mg/l near Doyle and one high TDS value at 2,965 mg/l at well #76 west of Turtle Mountain.

9.3 MT3D Water Quality Model

The MT3D water quality model was used to simulate the transport of TDS in the valley as a result of project pumping. MT3D is a solute transport numerical code which simulates advection, dispersion and chemical reactions in groundwater systems. It was developed by Papadopoulos and Associates with funding by the EPA. This model was selected for the following reasons:

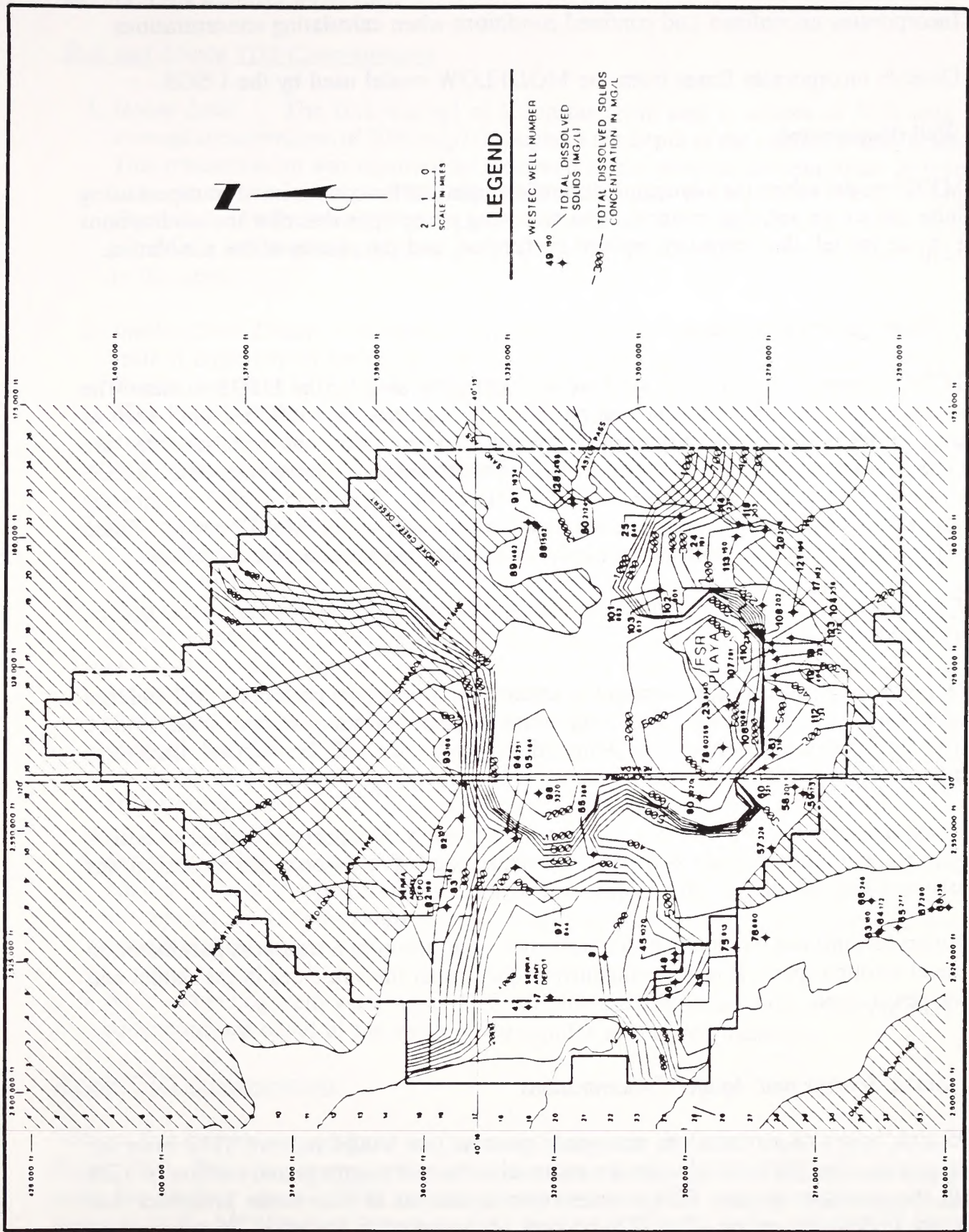


FIGURE 10
TDS MAP

1. Three-dimensional flow simulation capabilities.
2. Incorporates unconfined and confined conditions when calculating concentrations.
3. Directly incorporates fluxes from the MODFLOW model used by the USGS.
4. Well documented.

The MT3D model solves the advection, dispersion equation for contaminant transport using the finite difference solution method. The following paragraphs describe the assumptions made in the model, the sensitivity analysis performed, and the results of the simulation.

9.3.1 *Water Quality Parameters*

The MT3D transport model utilizes flow conditions generated by the USGS model. The values input into the USGS model and modified for the modified USGS model such as recharge, evapotranspiration, subsurface inflows and outflow, and transmissivity are therefore also assumed for the transport model. Assumptions and limitations of the USGS model are also therefore applicable to the MT3D model. Transport model parameters associated with water quality transport are required as input to the MT3D model. These model parameters and the assigned values for the model are summarized as follows:

1. *Effective porosity, N_e* - estimate of the cross-sectional area through which flow occurs; assumed to be 0.3.
2. *Dispersivity* - estimate of the amount of smear that a transport parameter will undergo as it travels through space. The longitudinal dispersivity was assumed to be 10 feet. The horizontal dispersivity was assumed to be 2 feet and the vertical transverse dispersivity was assumed to be 2 feet.
3. *Adsorption and Decay* - estimate of the tendency for a transport parameter to adsorb onto soil particles or decay as it travels through space. For a worst-case analysis it was assumed that no adsorption or decay occurs.
4. *Molecular diffusion* - estimate of the influence of diffusion of a transport parameter on travel through space. It is generally inconsequential at the velocities in the model and was set to zero.

9.3.2 *Sinks, Sources and Aquifer Concentrations*

A TDS sink refers to a natural or man-made process that would remove TDS from the aquifer system. The TDS model sinks are assumed to be well pumpage and outflow of TDS through the boundary areas. TDS sources refer to natural or man-made processes that would add TDS to the valley. The TDS sources are assumed to be inflow from boundary areas, concentration of TDS through evapotranspiration, and recharge. Sinks and sources

can be set as constant or variable, depending on the circumstances. Sinks, sources and aquifer TDS were set as follows:

Sink and Source TDS Concentrations

1. *Honey Lake* - The lake was set as a constant sink and/or source of TDS with an average concentration of 2000 mg/l throughout the depth of the aquifer at this location. This concentration was reported by Rockwell as the average concentration of Honey Lake at an elevation of 3986, the head value sink and/or in the USGS model (Rockwell, 1990). Setting Honey Lake as a constant concentration sink and/or source provides a worst-case analysis of the potential for Honey lake to impact water quality in this area.
2. *Smoke Creek Desert* - Constant sink and/or source concentrations were set at the eastern boundary to Smoke Creek Desert at 1500 mg/l. These are the TDS values observed at wells in the area. Depending on the hydraulic gradient and flow direction TDS may be added or removed from the Smoke Creek Desert area. However, throughout the simulation, flow was towards Smoke Creek Desert and TDS distribution in the area was generally maintained at 1,500 mg/l.
3. *Evapotranspiration Zones* - Evapotranspiration values occurring under 1988 conditions and under future conditions in Layer 1 were set as constant concentrations equivalent to the actual TDS value measured at this location in the aquifer. Evapotranspiration TDS flux was set at zero and the water flux distribution maintained the same as in the USGS model. In this manner the concentration of TDS in nodes where evapotranspiration was occurring in 1988, and in future scenarios, would continue to act as a source of that concentration of TDS in future simulations and result in a worst-case analysis of the potential for areas with high TDS to act as sources of high TDS to areas of low TDS. In the future pumping scenario, groundwater levels decrease below evapotranspiration extinction depth. When this occurs, constant concentration nodes are removed allowing TDS values to change in response to fluxes.
4. *Recharge* - TDS was set as a constant source of TDS in the model equivalent to the aquifer TDS at the point of application of recharge. The assumption was made to ensure that the TDS distribution in the valley under 1988 steady state conditions would remain stable.
5. *Wells* - Pumping wells were set as TDS variable concentration sinks removing TDS at concentrations equal to the value at the aquifer at the well location.

Aquifer TDS Concentrations

TDS in the aquifer was assigned in the model based on the 1988 distribution shown in Figure 10.0. For a worst-case analysis it was assumed that the TDS distribution was the same for all four layers. TDS concentrations in the aquifer beneath FSR playa were assigned in the MT3D model based on TDS data from wells in the area. Where specific data on TDS were not available, assumptions were made and a TDS concentration

considered reasonable for the area was selected based on the hydrology and geology. An area of particular concern given the proximity to the proposed project pumping wells is the playa located north and west of FSR, (hereafter referred to as FSR playa). No TDS data on groundwater are available within the central parts of the playa at FSR. The Ferrel playa well (#108) located along the southern edge of the playa contains good water at 202 mg/l. Based on existing data surrounding the FSR playa and the presence of a salt playa, it was assumed for the calibrated model that the playa TDS was 50,000 mg/l beneath the central part of the playa north of the Ferrel playa well.

9.4 Model Calibration

The USGS flow model with the western modification and Depot pumpage was used as input to the MT3D solute transport model. The USGS flow model was calibrated to 1988 flow conditions in Honey Lake Valley. The valley groundwater flow was assumed to be in steady state for this calibration. The same assumption was made for the MT3D solute transport model. TDS concentrations in the aquifer, observed from well samples representative of 1988 TDS shown in Figure 10.0, were assumed to represent the steady state distribution of TDS in the valley. This assumption is supported by historical TDS data of wells in the valley (Figures 9.0a and 9.0b), which indicate little variation in TDS over time in most locations where data are available. TDS concentrations were assigned to the aquifer based on existing data and were not adjusted. Source and sink TDS values were also assigned based on existing data and not adjusted. Recharge TDS was initially set to aquifer TDS at the particular recharge location and adjusted as needed in the TDS model to maintain a steady state TDS distribution over time under 1988 pumping conditions. The adjustment of recharge TDS was performed by simulating pumping at 1988 conditions of 5,910 acre-ft/yr at FSR and 2,000 acre-ft/yr at the SIAD in the model for a period of 100 years. The change in TDS throughout the aquifer after 100 years of steady state pumping was compared to initial TDS values using the Root Mean Square Difference (RMSD) in TDS (Section 5.1). Recharge TDS was then adjusted to better obtain minimal changes in TDS over time for 1988 conditions, thereby recreating the steady state 1988 TDS distribution. Figure 11.0 shows the areas used to calculate the RMSD. Table 13.0 compares the TDS after 100 years of pumping at steady state 1988 conditions to 1988 TDS values. As indicated in Table 13.0, the TDS model was calibrated to within 36 mg/l for the entire grid, and 69 mg/l at FSR for layers 1 and 2. For Layers 3 and 4 the calibration maximum was 40 mg/l for the entire grid and 141 mg/l for the FSR area, this indicating a steady state distribution of TDS was simulated with this TDS variation given the recharge, sink, source and aquifer TDS values assumed. Values in parentheses in Table 13 represent the RMSD when the dilution of interior FRS playa nodes is included in the calculations of RMSD averages per model area. This variation is due to good quality waters flowing into the playa's interior high-TDS nodes and slightly diluting the absolute TDS values at these locations. The dilution effect at the playa suggests the 50,000 mg/l TDS assignment to the interior nodes at the playa may be somewhat high, but does not influence the ability for the model to predict water quality impacts outside the FSR Playa.

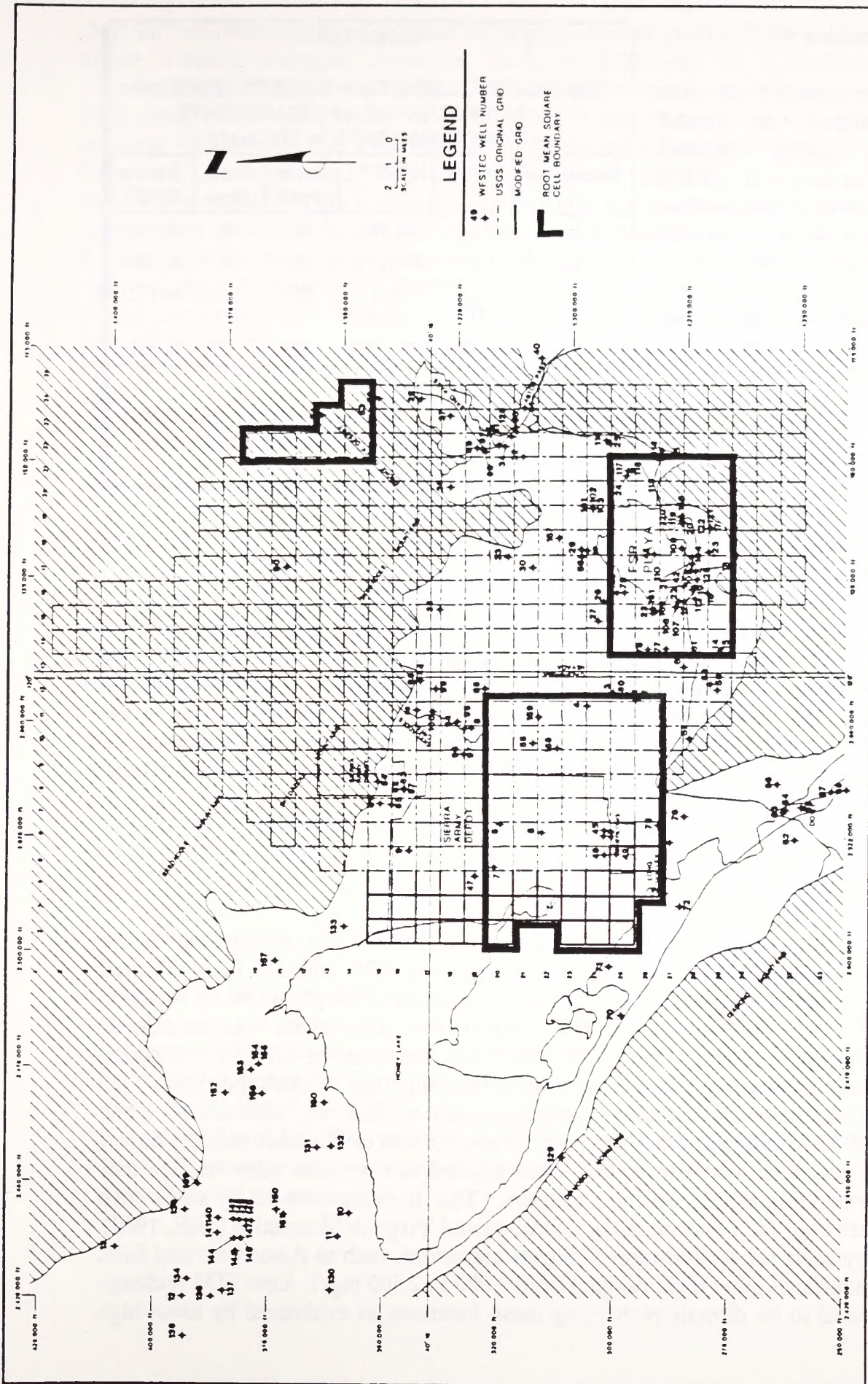


FIGURE 11.0

LOCATION OF CELLS USED IN THE TDS MODEL

TO CALCULATE ROOT MEAN SQUARE DIFFERENCE

AT THE SIERRA ARMY DEPOT, FSR AND SMOKE CREEK DESERT

9.5 Sensitivity Analyses

Sensitivity analyses were performed to evaluate the impact on model predictions from varying transport parameters and the TDS concentrations assumed for various sinks and sources and at aquifer locations. In particular, analyses were performed where uncertainties existed or where the model was considered sensitive to a given parameter. Sensitivity analyses were performed to evaluate the impact of:

1. Aquifer TDS concentrations at the FSR playa.
2. TDS concentration of recharge.
3. Effective porosity.
4. Dispersivity.

The sensitivity analyses were performed by changing a given parameter, simulating 1988 pumping of 5,910 acre-ft/yr at FSR and 2,000 acre-ft/yr at the SIAD for 100 years and subtracting the resulting TDS configuration at each grid location from the 1988 steady state TDS concentration after 100 years of pumping. This value was then compared to the calibrated value to determine the effect. The results of the sensitivity analyses are discussed below. A discussion of simulations to predict project pumping impacts on TDS distributions is included in Section 10.0.

9.5.1 TDS Recharge Concentration

Recharge TDS concentrations were assigned to reflect the TDS concentration in the aquifer at the point where recharge is applied. As a result, recharge TDS values in the calibrated model range from approximately 150 to 2,500 mg/l in areas outside FSR playa. Areal recharge was set to 50,000 mg/l for the interior FSR play model cells. This was considered reasonable as recharge applied in the USGS model was simulated as directly recharging groundwater without undergoing transport processes that might act to alter the initial TDS of recharge originating as precipitation, irrigation return flow or infiltration. The concentration of TDS in recharge from the point of application to the land surface, during transport through the unsaturated zone, and when applied to the water table surface may vary due to concentrating effects during transport. This is demonstrated by some high altitude springs with high TDS located in the Diamond and Virginia Mountains (JBR, 1989). Where data are available for groundwater at higher elevations, such as Astor Pass and Sand Pass, TDS in the aquifer is quite high, ranging from 1,000 to 2,500 mg/l. Low TDS recharge water is not expected to be directly recharging these locations as evidenced by these high concentrations.

TABLE 13.0					
TDS MODEL CALIBRATION RESULTS AFTER 100 YEARS OF PUMPING AT STEADY STATE CONDITIONS (RMSD in TDS mg/l)					
Simulation	Depot	FSR ^{(a)(b)}	Astor Pass	Sand Pass	Entire Grid ^(b)
L1	43	59 (99)	30	9	36 (40)
L2	23	69 (279)	30	5	28 (64)
L3	10	141 (313)	29	1.0	40 (72)
L4	4.0	77 (132)	25	0.5	21 (31)
^(a) FSR = Fish Springs Ranch					
^(b) Values in parentheses indicate RMSD including interior FSR playa node-dilution effect for 50,000 mg/l cells.					

Only limited information exists concerning groundwater quality in the mountain blocks. To better simulate transport processes, recharge TDS was set to reflect the observed concentrations in these areas. High TDS recharge in these areas is necessary to achieve the 1988 steady state distribution. To evaluate the sensitivity to the overall model to TDS recharge values, recharge TDS was uniformly decreased and then increased by a factor of 2 from the calibrated value. The RMSD between the calibrated TDS change relative to the variation in recharge TDS is shown in Table 14.0. The results indicate recharge TDS in the model when decreased by a factor of 2 results in a maximum average RMSD in TDS of ± 4.5 mg/l for the entire grid compared to the calibrated 1988 TDS values. When TDS is increased by a factor of 2 the RMSD in TDS is 9 to 339 mg/l in Layer 1, with the greatest change occurring in the interior of FSR Playa at the location of the 50,000 mg/l TDS cells. The effect is more pronounced in Layer 1 where recharge is applied than in deeper layers. The results indicate some sensitivity to the TDS concentration of recharge in Layer 1 of the model.

9.5.2 *Effective Porosity*

Effective porosity, or N_e , is the cross-sectional area of the aquifer through which flow occurs. It is inversely related to the average linear velocity and will affect the rate at which transport of a solute travels. For the calibrated case, N_e was assumed to be 0.3, a commonly used average value for effective porosity. To evaluate the impact of this assumption on the results, N_e was varied from 0.2 to 0.4. This range in N_e encompasses the most likely variation in N_e , although in some very fine-grained sediments N_e may be smaller. The results of varying N_e are summarized in Table 14.0 and indicate that overall the model is not very sensitive to N_e . When N_e is decreased to 0.2 the result is an increase in velocities and greater travel of TDS as reflected in the RMSD for the entire grid of up to 35 mg/l. Variation is higher in the FSR area with a maximum of 153 mg/l in Layer 3 from changes in the interior of FSR Playa. Increasing N_e to 0.4 has the opposite effect of decreasing the velocities and the resulting changes in TDS.

9.5.3 *Dispersivity*

Dispersivity or mechanical dispersion will cause a transport parameter to move more slowly or quickly than the average linear velocity of water. As a result, the transport parameter will spread out from its original path line. Dispersivity was set at 10 feet in the longitudinal direction and 2 feet in the horizontal and transverse direction in the calibrated model. To evaluate the impact of this value on transport, dispersivity was decreased and then increased by a factor of 2 and 10. The results in Table 14.0 indicate dispersion has little influence on transport, as there are few variations in predicted TDS changes in 100 years when compared to the calibrated values.

TABLE 14.0

TDS SENSITIVITY RESULTS (RSMD in TDS mg/l)

Simulation		Entire Grid	Depot Area	FSR ^(a)	Astor Pass	Sand Pass
Decrease recharge TDS by 2	L1	4.5	7.5	169	72	5.0
	L2	2.4	0.01	3.7	0.7	0.5
	L3	0.7	0.0	0.1	0.0	0.0
	L4	0.0	0.0	0.0	0.0	0.0
Increase recharge TDS by 2	L1	88	15	339	140	9.2
	L2	4.7	0.01	7.4	1.4	0.0
	L3	0.13	0.0	0.3	0.0	0.0
	L4	0.0	0.0	0.0	0.0	0.0
Decrease Ne by 0.2	L1	18.9	15	48	13.9	4.3
	L2	32	10.2	137	16.5	2.5
	L3	35	4.8	153	14.7	0.5
	L4	16	2.0	66	12.6	0.3
Increase Ne to 0.4	L1	9.7	8.7	24	7.5	2.2
	L2	16	5.4	69	7.9	1.4
	L3	18	2.4	77	7.2	0.4
	L4	7.9	0.9	33	6.4	0.3
Decrease dispersivity by 2	L1	0.09	0.03	0.32	0.0	0.0
	L2	0.09	0.01	0.33	0.0	0.0
	L3	0.08	0.0	0.30	0.0	0.0
	L4	0.05	0.0	0.23	0.0	0.0
Increase dispersivity by 2	L1	0.15	0.13	0.59	0.0	0.0
	L2	0.15	0.04	0.63	0.0	0.0
	L3	0.08	0.0	0.32	0.3	0.0
	L4	0.07	0.0	0.3	0.0	0.0
Increase dispersivity by 10	L1	1.3	0.48	5.5	0.6	0.0
	L2	0.6	0.18	2.5	0.3	0.0
	L3	0.6	0.18	2.5	0.3	0.0
	L4	0.5	0.12	1.9	0.0	0.0

FSR = Fish Springs Ranch

The results of the sensitivity analyses indicate:

1. The TDS concentration assumed for recharge will influence TDS transport within the ranges tested with an RMSD in TDS of up to 339 mg/l in Layer 3. The influences that are shown are limited largely to the first model layer.
2. Effective porosity slightly influences TDS over 100 years within a range of 35 mg/l and a maximum of 153 mg/l within FSR playa.
3. Dispersivity does not significantly influence TDS transport.

The results indicate the TDS model can reasonably simulate TDS changes due to pumping given the calibrated values used within an accuracy of ± 69 mg/l for Layers 1 and 2, 141 mg/l for Layer 3, and 77 mg/l for Layer 4. Varying parameters within reasonable ranges does not result in highly significant changes in the results predicted.

9.6 TDS Model Results

The predicted change in TDS in the valley aquifer from the proposed project pumpage was simulated by increasing the pumping at FSR from 5,910 acre-ft/yr to 13,000 acre-ft/yr and continuing pumping at steady-state flux conditions for 100 years. The 100-year time frame is an arbitrarily selected time interval used to evaluate impacts 100 years into the future and does not represent the time required to reach equilibrium. The TDS model parameters were set to calibrated values discussed in Section 9.4 with FSR playa TDS set at 50,000 mg/l. Depot pumpage was set at 2,000 acre-ft/yr in both the 1988 and future simulations. The TDS distribution obtained from the future pumping scenario was subtracted from the steady state distribution of TDS obtained after 100 years of 1988 pumping conditions. The resulting TDS distribution for Layers 1 and 2 is shown on Figure 12.0a and represents the weighted average of TDS for these layers. Figure 12.0a represents the expected changes in TDS in Honey Lake Valley due to the increased pumping at FSR for the aquifer used by the majority of wells in the valley. Figures 12.0b and 12.0c represent predicted TDS changes for Layers 3 and 4. TDS model results are subject to the same limitations as the modified USGS model due to the necessity to simplify complex physical processes for computer simulation. In addition, no TDS data reflecting changes in TDS over time were available for temporal TDS calibration. A detailed discussion of results by areas follows.

9.6.1 FSR

Figures 12.0a, 12.0b and 12.0c depict the predicted changes in TDS concentrations from 1988 values resulting from pumpage of 13,000 acre-ft/yr at FSR, assuming the interior of FSR playa TDS is 50,000 mg/l. The results indicate that very little TDS variation will occur south and east of the FSR playa in the area where proposed project wells are located. In most areas, a change of plus or minus 50 mg/l at a maximum is indicated. This is due to the flux and velocity distributions in the area. Figure 13.0 depicts the fluxes or flow rate of water in Layer 1 between model grid locations. The arrows indicate the flow direction. Due to large amounts of recharge in the south and east in the Virginia Mountains, flow is predominantly north and west in area that are south and east of the playa. Where project pumping reverses this gradient, the flux and resulting flow velocities are small, ranging from 330 to 5,082 cubic feet per day. These flow rates correspond to migration distances an average of 160 feet and a maximum of 551 feet in 100 years, assuming an effective porosity of 0.3, and using an average aquifer thickness of Layer 1 of 203 to 226 feet and a width of 1 mile.

Table 15.0 summarizes the results of the analyses by indicating TDS changes at key locations in the model. The locations are the proposed project pumping wells P-1 through P-9 located south and east of FSR playa, Astor Pass, Sand Pass and the Sierra Army Depot. Well P-1

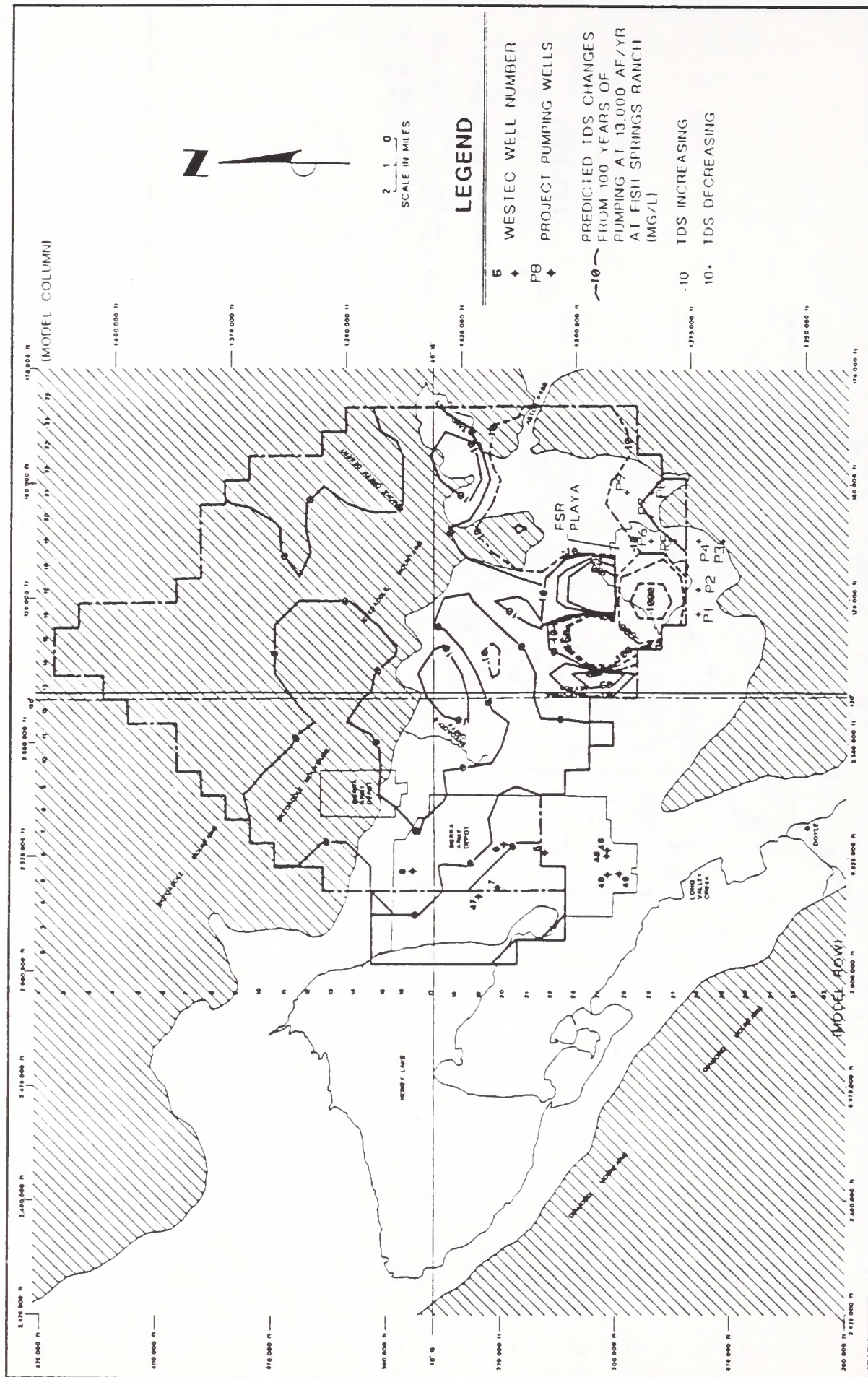


FIGURE 12.0c

PREDICTED TDS CHANGE FROM 100 YEARS

PUMPING AT 13,000 AF/YR AT FSR. LAYER 4

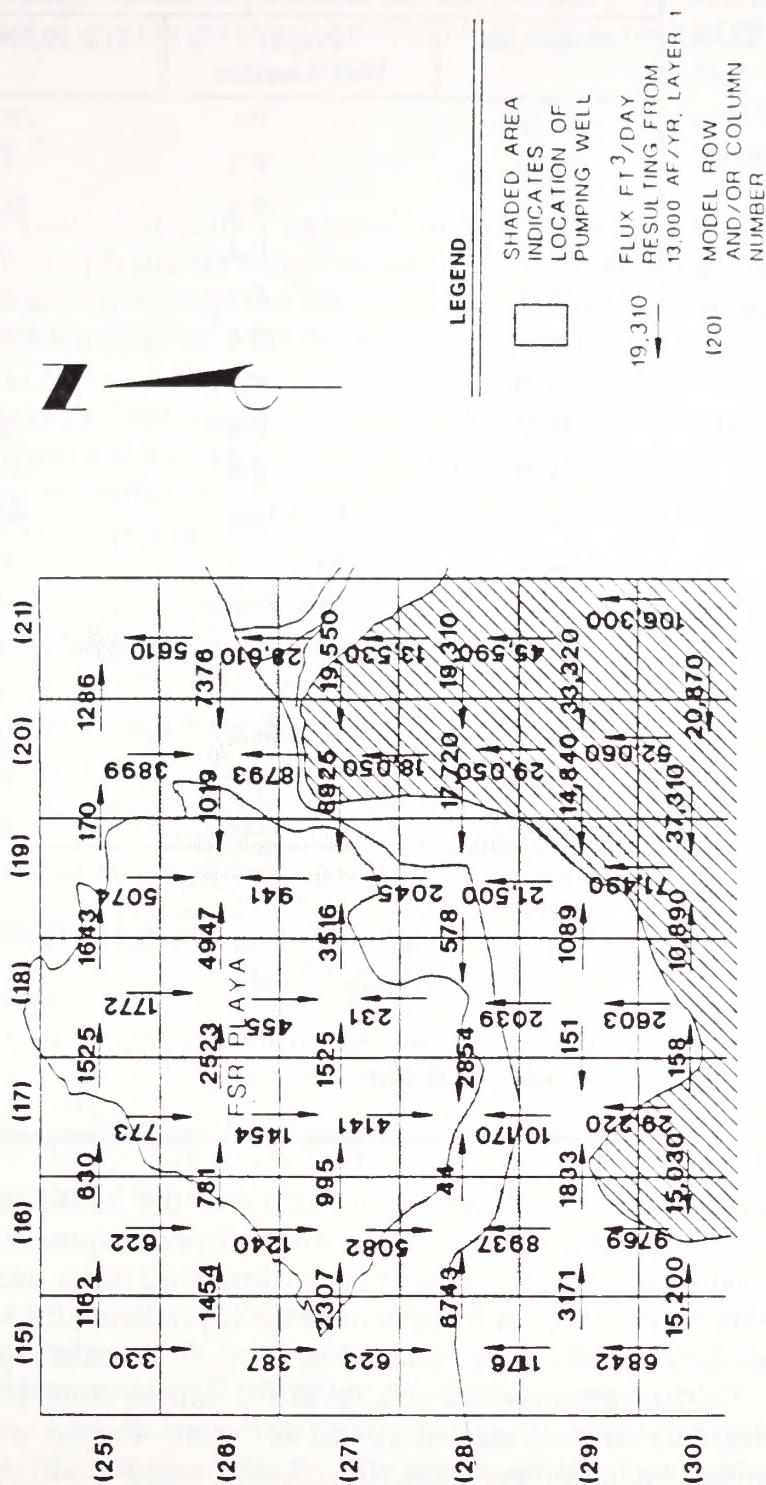


FIGURE 13.0
FLUXES IN FSR AREA
RESULTING FROM PROPOSED PUMPING

TDS increases by 37.4 mg/l, P-2 increases by 5.6 mg/l. P-3, P-4, and P-5 improve slightly or do not change. At well P-6, TDS increases by 1,319 mg/l. As indicated in Figure 12a, well P-6 is located in the playa for purposes of model simulation within the center of the 1-mile-square grid used for the modeling analysis. In reality, well P-6 is expected to be located approximately 1 mile east of the location shown on Figure 12.0b where increases are predicted to be minimal. Wells P-7, P-8, and P-9 increased by 6.4, 38.9, and 61.4 mg/l, respectively.

In areas adjacent to the high TDS zone of 50,259 ppm near well #78 at the western extent of FSR playa and the interior of the playa (Figure 10.0), some migration of TDS occurs, as shown by the zone of increasing TDS overlying the playa area. The migration results in an average increase in TDS of 100 mg/l approximately 2 miles to the east of the center of the high TDS zone in the playa. The shift of the high TDS zone to the east is reflected by the decrease in TDS to the west of the FSR Playa.

This shift is due to evapotranspiration ceasing in that area under the 13,000 acre-ft/yr pumping scenario, allowing TDS to migrate without replacement from evapotranspiration concentrating effects. Project pumping wells are located approximately 2 miles south of the high TDS zone (Figure 12.0a through 12.0c). A 37 ppm increase is predicted for wells P-1, an increase of 1,319 mg/l is predicted for well P-6, and a 6 to 61 mg/l increase is predicted near wells P-7, P-8 and P-9. Existing groundwater quality at P-1 ranges from 162 to 460 ppm, resulting in an overall increase in the range of 199 to 497 ppm. Project well P-6 is located within the playa for model simulation purposes. In actuality, well P-6 will be located about 1 mile east of the model location and therefore will not be impacted. Existing groundwater quality at wells P-7, P-8 and P-9 contains TDS in the range of 200 ppm and is predicted to increase up to 261 ppm. The TDS in Layers 3 and 4 migrate slightly farther south and west than TDS in Layers 1 and 2. This may be due to limited influences from the shallow evapotranspiration which decreases under the future pumping scenario. Layer 1 and 2 reflect this decreasing evapotranspiration causing a decrease in TDS west of the

TABLE 15.0		
IMPACT ON TDS AT KEY MODEL LOCATIONS ^(a)		
Model Cell	Project Well/Location	TDS 50,000 mg/l
28,16	P-1	-37.4
28,17	P-2	-5.5
29,19	P-3	55.6
28,19	P-4	0.0
27,19	P-5	0.0
26,19	P-6	-1,319
26,20	P-7	-6.4
26,21	P-8	-38.9
25,21	P-9	-61.4
22,24	Astor Pass	-40
12,22	Sand Pass	0.0
13,23	Sand Pass	0.0
14,24	Sand Pass	0.0
23,7	Depot	0.0
24,7	Depot	0.0
25,7	Depot	0.0
26,7	Depot	0.0

^(a) Values ≤ 5.0 mg/l considered equivalent to zero due to round-off error.
Note: Values represent weighted average for layers 1 and 2 using: $\frac{233 (x_1) + 700 (x_2)}{933}$
(-) indicates TDS increasing
(+) indicates TDS decreasing

FSR playa. Deeper layers would be less influenced resulting in more TDS available for migration. Increases in TDS in Layers 3 and 4 are not considered relevant to evaluating project pumping impacts as project wells pump from Layers 1 and 2 only and Layers 3 and 4 are located at depths greater than 1,000 feet below the top of the water table.

9.6.2 *Astor Pass*

Existing TDS values at Astor Pass range from 1,600 to 2,500 mg/l. The model reflects these concentrations with similar values assigned to groundwater south and north of Astor Pass. Due to increased pumping, the saturated thickness of Layer 1 decreases slightly, resulting in an average increase in TDS in this area of 40 ppm. This corresponds to an average increase of 1,640 to 2,540 ppm or an increase of 1.6 percent compared to present day maximum TDS concentrations. Outflow to Pyramid Lake due to project pumping decreased 35 percent from 1,455 to 953 acre-ft/yr per year. As the TDS has only slightly increased, the resulting potential salt loading to Pyramid Lake is decreased by approximately 35 percent due to project pumping.

9.6.3 *Smoke Creek Desert*

Very small TDS changes due to project pumping are predicted in the model area adjacent to Smoke Creek Desert. Flow is toward Smoke Creek Desert and impacts from pumping do not result in any meaningful impacts to TDS based on the model predictions.

9.6.4 *Sierra Army Depot*

No TDS impacts are predicted for the SIAD from FSR pumping for the time period simulated. This is supported by the groundwater flow simulations, which indicate an impact of an average 5 feet of drawdown at the Depot from increased FSR pumping (Figures 8.0a through 8.0d). Water quality of Honey Lake also appears to have little impact on water quality at the Depot. This is due to the small amount of flow from Honey Lake east toward the Depot and small fluxes in the east direction and is true even with the addition of Depot pumpage.

The Sierra Army Depot is presently involved in identifying several chemical contaminant plumes in groundwater at the Depot. Concern has been raised by the SIAD related to the potential for increased FSR pumpage to adversely impact remediation efforts to clean up these plumes. The cleanup effort is anticipated to occur sometime in the future after the plumes have been characterized. The results of the flow and water quality simulations indicate FSR pumpage has a minor influence on water levels at the Depot, as shown by the calculation of an average RMSD change in heads at the Depot of 7 feet in Layer 1 from the increase in FSR pumping with most head changes less than 5 feet. Water quality modeling of TDS in the valley indicates virtually no influence on TDS migration at the Depot from FSR pumpage. Flow rate and velocity increases predicted to occur due to FSR pumpage are very small at the Depot. Flow rate increases range from 360 to 2900 ft³/day. Average

linear flow velocities calculated by dividing the flow rate by the aquifer thickness and effective porosity of 0.3 result in estimates of 0.0008 to 0.0026 ft/day. Using a chemical retardation factor of 2.3 (estimated by Wilson et. al.) for organic contaminants in groundwater, this translates to a maximum contaminant migration rate of 37 feet in 100 years due to pumping at FSR of 13,000 acre-ft/yr.

The drawdowns predicted from the increased pumping at FSR are simulated for steady state conditions at full project pumping. In reality project pumping will be incrementally increased yearly and steady state conditions will not be achieved for decades. FSR pumping increases are not expected to adversely impact water quality at the SIAD for the following reasons:

1. Water level changes at the Depot from FSR pumping are predicted to be an average of 5 feet at steady state pumping at full production. Full production is not expected for 20 years and steady state conditions will not be achieved for many decades.
2. No TDS changes are predicted at the Depot from FSR pumpage.
3. Contaminants are predicted to have the potential to migrate 37 feet in 100 years due to FSR project pumping.
4. Remediation of the existing contaminant plumes is expected to occur much sooner than any potential water level changes resulting from FSR pumpage.

9.6.5 Individual Well Users

Private domestic well users in eastern Honey Lake Valley could be impacted by changing TDS due to project pumpage depending on their proximity to the high TDS area west and in the interior of FSR playa. In general, wells that are located in this area would be expected to have high TDS values, and water may not be potable. Increases predicted over the next 100 years are anticipated to be approximately 100 mg/l and may not result in a significant increase relative to the existing water quality.

10.0 Water Quality Environmental Impact Analyses

Water quality impacts associated with increasing FSR pumpage to 13,000 acre-ft/yr were evaluated using a water quality transport model. Water quality would be impacted near the area of existing high TDS within FSR playa. TDS is predicted to increase by approximately 100 mg/l about 2 miles to the east of this high TDS zone 100 years after pumping at FSR at 13,000 acre-ft/yr. Small increases in TDS of 6 to 61 mg/l are predicted east of FSR playa and some increases in TDS of less than 40 mg/l may occur directly south of FSR playa.

Existing groundwater quality at Astor and Sand Passes is poor with TDS ranging from 1,600 to 2,500 mg/l. As a result of increased pumpage at FSR, a slight increase in TDS at Astor

Pass of on average 40 mg/l is predicted. The increase in TDS of 40 mg/l represents an overall average increase in TDS in groundwater in this area of 1.6 percent when compared to existing quality and is not considered significant when compared to existing groundwater quality in Astor Pass. No TDS increases are predicted for Sand Pass or the boundary area adjacent to Smoke Creek Desert.

The SIAD is presently investigating groundwater contaminant plumes at their facility. FSR pumpage is not expected to impact activities such as groundwater plume characterization or remediation because FSR impacts on water levels is minor at an average of 5 feet. Maximum contaminant migration distances at the Depot from increases in pumping at FSR are predicted to be 37 feet after 100 years of pumping. Remediation of the groundwater at the SIAD should occur long before FSR pumpage results in the small change in water levels and contaminant distributions identified.

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APPENDIX D

VEGETATION

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TABLE D-1
COMMON AND SCIENTIFIC NAMES FOR PLANT SPECIES REFERRED TO IN TEXT

COMMON NAMES

SCIENTIFIC NAMES

Trees:

Fremont cottonwood
Aspen
Willow
Curlleaf mountain mahogany
Western juniper
Utah juniper
Pinyon pine
Tamarisk
Russian olive

Populus fremontii
Populus tremuloides
Salix spp.
Cercocarpus ledifolius
Juniperus occidentalis
Juniperus osteosperma
Pinus monophylla
Tamarix spp.
Elaeagnus angustifolia

Shrubs:

Gooseberry
Australian saltbush
Wyoming big sagebrush
Basin big sagebrush
Mountain big sagebrush
Low sagebrush
Lahontan low sagebrush
Budsage
Douglas rabbitbrush
Rubber rabbitbrush
Littleleaf horsebrush
Dalea
Western currant
Serviceberry
Desert snowberry
Wild rose
Antelope bitterbrush
Desert peach
Chokecherry
Spiny hopsage
Shadscale
Fourwing saltbush
Black greasewood
Bailey's greasewood
Pickleweed
Seepweed
Nevada ephedra
Green ephedra
Purple sage
Winterfat

Ribes spp.
Atriplex semibaccata
Artemisia tridentata wyomingensis
Artemisia tridentata tridentata
Artemisia tridentata vaseyana
Artemisia arbuscula
Artemisia arbuscula longicaulus
Artemisia spinescens
Chrysothamnus douglasii
Chrysothamnus nauseosus
Tetradymia glabrata
Dalea candida
Ribes aureum
Amelanchier alnifolia
Symphoricarpos longiflorus
Rosa woodsii
Purshia tridentata
Prunus andersonii
Prunus emarginata
Grayia spinosa
Atriplex canescens
Atriplex confertifolia
Sarcobatus vermiculatus
Sarcobatus baileyi
Allenrolfea occidentalis
Suaeda torreyana
Ephedra nevadensis
Ephedra viridis
Salvia spp.
Ceratoides lanata

COMMON NAMES

Grasses and Related Species:

Fowl mannagrass
Indian ricegrass
Thurber needlegrass
Desert needlegrass
Needle and thread
Bottlebrush squirreltail
Saltgrass
Western wheatgrass
Bluebunch wheatgrass
Slender wheatgrass
Idaho fescue
Cheatgrass
Bluegrasses
Tufted hairgrass
Bentgrass
Basin wildrye
Creeping wildrye
Sedges
Rushes
Tall bulrush (tule)
Cattail
Duck weed

Forbs:

Wild Strawberry
Stinging nettle
Filaree
Clover
Watercress
Horsetail
Hooker balsamroot
Arrowleaf balsamroot
Mulesear wyethia
Phlox
Indian paintbrush
Princes plume
Buckwheat
Altered andesite buckwheat
Nevada oryctes
Globemallow
Buttercup
Cinquefoil
Horehound
Lupine
Dock
Mullein
Russian thistle
Horsetail
Pondweed

SCIENTIFIC NAMES

Glyceria striata
Oryzopsis hymenoides
Stipa thurberii
Stipa speciosa
Stipa comata
Sitanion hystrix
Distichlis stricta
Agropyron smithii
Agropyron spicatum
Agropyron trachycalum
Festuca idahoensis
Bromus tectorum
Poa spp.
Deschampsia caespitosa
Agrostis stolonifera
Elymus cinereus
Elymus spp.
Carex spp.
Juncus spp.
Scirpus spp.
Typha spp.
Lemna minor

Fragaria spp.
Urtica dioica
Eriogonum cicutarium
Trifolium spp.
Rorippa nasturtium
Equisetum spp.
Balsamorhiza hookerii
Balsamorhiza sagittata
Wyethia glabra
Phlox spp.
Castilleja spp.
Stanleya pinnata
Eriogonum spp.
Eriogonum lobbiai var. robustum
Oryctes nevadensis
Sphaeralcea spp.
Ranunculus spp.
Potentilla spp.
Marrubium vulgare
Lupinus spp.
Rumex spp.
Verbascum thapsus
Salsoa iberica
Equisetum spp.
Potamogeton spp.

TABLE D-2			
ECOLOGICAL SITES WITHIN VEGETATION COMMUNITIES IN THE WATER SOURCE AREA ^(a)			
Ecological Site No.	Site Name and Precipitation Zone (in inches)	Present Vegetation	Potential Vegetation
Black Greasewood Community:			
24-15	Deep sodic fan 8-10	Torrey saltbush Basin wildrye Black greasewood	Torrey saltbush Basin wildrye
27-12	Sodic sands	Black greasewood Indian ricegrass Dalea	Black greasewood Indian ricegrass
27-25	Sodic flat 4-8	Black greasewood Seepweed Bottlebrush squirreltail	Black greasewood Shadscale Saltgrass
Black Greasewood - Shadscale Transitional Community:			
24-3	Sodic terrace 6-8	Black greasewood Cheatgrass Shadscale Bottlebrush squirreltail	Black greasewood Shadscale Basin wildrye Basin big sagebrush
Black Greasewood - Basin Big Sagebrush - Basin Wildrye Community:			
24-6	Dry floodplain 6-10	Black greasewood Basin big sagebrush Rubber rabbitbrush Basin wildrye	Black greasewood Basin big sagebrush Western wheatgrass Basin wildrye
Shadscale Community:			
24-2	Loamy 5-8	Shadscale Russian thistle Cheatgrass	Shadscale Bud sagebrush Indian ricegrass
27-13	Loamy 4-8	Shadscale Bud sagebrush Bottlebrush squirreltail	Shadscale Bud sagebrush Indian ricegrass
Wet Meadows:			
23-25	Wet Meadow	Rush Sedges Wild rose	Tufted hairgrass Sedges Rushes
26-2	Wet sodic bottom 4-8	Black greasewood Saltgrass Seepweed	Black greasewood Saltgrass Creeping wildrye

TABLE D-2 (Continued)

ECOLOGICAL SITES WITHIN VEGETATION COMMUNITIES IN THE WATER SOURCE AREA^(a)

Ecological Site No.	Site Name and Precipitation Zone (in inches)	Present Vegetation	Potential Vegetation
Sagebrush - Bitterbrush Community:			
26-8	Granitic fan 10-12	Mountain big sagebrush Bottlebrush squirreltail Bitterbrush	Mountain big sagebrush Bitterbrush Needle and thread
26-14	Dune 10-12	Desert peach Wyoming big sagebrush Cheatgrass	Desert peach Indian ricegrass Bitterbrush
Sagebrush Uplands Community:			
23-6	Loamy 8-10	Wyoming big sagebrush Cheatgrass Bottlebrush squirreltail	Wyoming big sagebrush Indian ricegrass Thurber needlegrass
23-11	Dune 8-10	Basin big sagebrush Fourwing saltbush Bottlebrush squirreltail	Indian ricegrass Basin big sagebrush Needle and Thread
23-20	Loamy 10-12	Mountain big sagebrush Bottlebrush squirreltail Thurber needlegrass	Big sagebrushes Bluebunch wheatgrass
23-30	Eroded So. Slope 8-12	Purple sage Horsebrush Desert needlegrass	Purple sage Wyoming big sagebrush Desert needlegrass
23-31	Claypan 10-14	Low sagebrush Sandberg bluegrass	Thurber needlegrass Low sagebrush
23-33	Clayey 10-14	Basin big sagebrush Rubber rabbitbrush Sandberg bluegrass	Basin big sagebrush Western wheatgrass Creeping wildrye
23-36	Juniper Woodland	Western juniper Sandberg bluegrass Douglas rabbitbrush	Western juniper Bluebunch wheatgrass Snowberry
23-27	Clay slope 8-12	Lahontan low sagebrush Sandberg bluegrass Hooker balsamroot	Lahontan low sagebrush Bluebunch wheatgrass Thurber needlegrass
23-38	Droughty loam 8-10	Wyoming big sagebrush Indian ricegrass Spiny hopsage	Indian ricegrass Desert needlegrass Wyoming big sagebrush
23-29	Loamy slope 10-14	Mountain big sagebrush Cheatgrass Bottlebrush squirreltail	Big sagebrushes Bluebunch wheatgrass

TABLE D-2 (Continued)

ECOLOGICAL SITES WITHIN VEGETATION COMMUNITIES IN THE WATER SOURCE AREA^(a)

Ecological Site No.	Site Name and Precipitation Zone (in inches)	Present Vegetation	Potential Vegetation
Sagebrush Uplands Community (continued)			
23-44	Very cobbly claypan 10-12	Low sagebrush Rabbitbrushes Bottlebrush squirreltail	Low sagebrush Sandberg bluegrass Thurber needlegrass
23-47	Gravelly clay 8-10	Lahontan low sagebrush Sandberg bluegrass Bottlebrush squirreltail	Lahontan low sagebrush Sandberg bluegrass Desert needlegrass
23-51	Sandy 8-12	Wyoming big sagebrush Rabbitbrushes Bottlebrush squirreltail	Desert needlegrass Indian ricegrass Basin big sagebrush
24-34	Droughty loam 4-8	Wyoming big sagebrush Winterfat Cheatgrass	Indian ricegrass Bud sagebrush Winterfat
26-20	Sandy 8-10	Wyoming big sagebrush Spiny hopsage Cheatgrass	Wyoming big sagebrush Needle and thread Thurber needlegrass
26-22	Shallow stony loam 8-10	Wyoming big sagebrush Sandberg bluegrass Douglas rabbitbrush	Wyoming big sagebrush Desert needlegrass Green ephedra
^(a)	Data from SCS, 1983		

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APPENDIX E

WILDLIFE

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TABLE E-1

BIRD SPECIES LIST FOR THE AFFECTED AREA

This lists represents birds seen or otherwise known to occur in the area. "Summer and year-round residents" are known or presumed to nest in the area. "Probable residents" have been seen in or near the area at all times of the year; high probability exists that they nest and/or reside in the area. "Possible residents" may nest and/or reside in the area but evidence is limited. "Sp." identified only to genus. "Spp." identified to genus, more than one species present. (Modified from JBR, 1989; 1990)

<u>Species</u>	<u>Observations</u>
<u>Common and Scientific Names</u>	
Double-crested Cormorant (<i>Phalacrocorax auritus</i>)	Two individuals on ditch, High Rock Ranch
American Bittern (<i>Botaurus lentiginosus</i>)	One individual, Bonham Ranch wetlands
Tundra Swan (<i>Cygnus columbianus</i>)	Fall, one pond in Virginia Mountains
Mallard (<i>Anas platyrhynchos</i>)	Resident, ponds and reservoirs
Pintail (<i>Anas acuta</i>)	Spring and summer, ponds and reservoirs
Green-winged Teal (<i>Anas crecca</i>)	Spring and fall, ponds and reservoirs
Cinnamon Teal (<i>Anas cyanoptera</i>)	Spring and fall, ponds and reservoirs
Shoveler (<i>Anas cylpeata</i>)	Fall, ponds and reservoirs
Turkey Vulture (<i>Cathartes aura</i>)	Probable spring and summer resident
Goshawk (<i>Accipiter gentilis</i>)	Fall migrant, possible fall-winter resident
Sharp-shinned Hawk (<i>Accipiter striatus</i>)	Riparian areas, possible resident
Cooper's Hawk (<i>Accipiter cooperii</i>)	Riparian areas, possible resident
Red-tailed Hawk (<i>Buteo jamaicensis</i>)	Resident
Swainson's Hawk (<i>Buteo swainsoni</i>)	Late spring - summer resident
Rough-legged Hawk (<i>Buteo lagopus</i>)	Fall - spring
Ferruginous Hawk (<i>Buteo regalis</i>)	Fall - spring
Golden Eagle (<i>Aquila chrysaetos</i>)	Year-round resident

SpeciesObservationsCommon and Scientific Names

Bald Eagle (<i>Haliaeetus leucocephalus</i>)	Fall - spring
Northern Harrier (Marsh Hawk) (<i>Circus cyaneus</i>)	Probable year-round resident
Peregrine Falcon (<i>Falco mexicanus</i>)	May be occasional resident
Prairie Falcon (<i>Falco mexicanus</i>)	Probable year-round resident
American Kestrel (<i>Falco sparverius</i>)	Year-round resident
Sage Grouse (<i>Centrocercus urophasianus</i>)	Uncommon resident, most commonly seen in mountains
California Quail (<i>Callipepla californica</i>)	Resident, riparian areas
Mountain Quail (<i>Oreotyx pictus</i>)	Uncommon in mountains, near riparian habitats
Chukar (<i>Alectoris chukar</i>)	Resident, mountains, rocky areas
Western Least Bittern (<i>Ixobrychus exilis</i>)	Marsh-dwelling species, probably does not occur in the affected area
White-Faced Ibis (<i>Plegadis chihi</i>)	Known to occur at wetlands, north of Honey Lake
Greater Sandhill Crane (<i>Grus canadensis</i>)	Known to use Honey, Duck and Calneva Lakes
Sora (<i>Porzana carolina</i>)	One individual, wetland in Smoke Creek Desert
American Coot (<i>Fulica americana</i>)	Spring and fall, ponds and reservoirs
Killdeer (<i>Charadrius vociferous</i>)	Common near water, spring and fall
Western Snowy Plover (<i>Charadrius alexandrinus</i>)	Nesting at Honey lake
Common Snipe (<i>Gallinago gallinago</i>)	Probable resident, springs and creeks
American Avocet (<i>Recurvirostra americana</i>)	Spring, ponds and reservoirs
Mourning Dove (<i>Zenaida macroura</i>)	Common, spring and fall
Great Horned Owl (<i>Bubo virginianus</i>)	Year-round resident

<u>Species</u>	<u>Observations</u>
<u>Common and Scientific Names</u>	
Northern Pygmy-owl (<i>Glaucidium gnoma</i>)	Fall, juniper habitats
Burrowing Owl (<i>Athene cunicularia</i>)	Spring-fall, nest found in Honey Lake Valley
Short-eared Owl (<i>Asio flammeus</i>)	Probable year-round resident, riparian areas
Poorwill (<i>Phalaenoptilus nuttallii</i>)	Summer resident, known to hibernate in winter
Common Nighthawk (<i>Chordeiles minor</i>)	Summer resident
Northern (Red-shafer) Flicker (<i>Colaptes auratus</i>)	Year-round resident
Western Kingbird (<i>Tyrannus verticalis</i>)	Probable summer resident
Say's Phoebe (<i>Sayornis saya</i>)	Summer resident
Empidonax Flycatcher(s) (<i>Empidonax spp.</i>)	Migrant, riparian areas
Western Wood Pewee (<i>Contopus sordidulus</i>)	Migrant, riparian areas
Olive-sided Flycatcher (<i>Contopus borealis</i>)	Fall migrant
Horned Lark (<i>Eremophila alpestris</i>)	Year-round resident
Rough-winged Swallow (<i>Stelgidopteryx serripennis</i>)	Probable summer resident
Barn Swallow (<i>Hirundo rustica</i>)	Summer resident
Cliff Swallow (<i>Hirundo pyrrhonota</i>)	Summer resident
Bank Swallow (<i>Riparia riparia</i>)	No suitable habitat identified
Scrub Jay (<i>Aphelocoma coerulescens</i>)	Resident
Black-billed Magpie (<i>Pica pica</i>)	Resident
Common Raven (<i>Corvus corax</i>)	Year-round resident
American Crow (<i>Corvus brachyrhynchos</i>)	Agricultural area, mostly west of study area

SpeciesObservationsCommon and Scientific Names

Pinyon Jay (<i>Gymnorhinus cyanocephalus</i>)	Resident, juniper habitats
Clark's Nutcracker (<i>Nucifraga columbiana</i>)	Rare, winter
Mountain Chickadee (<i>Parus gambeli</i>)	Rare, fall, juniper habitats
Plain Titmouse (<i>Parus inornatus</i>)	Fall, juniper habitats
Bushtit (<i>Psaltirparus minimus</i>)	Fall and winter, juniper and shrubland habitats
Bewick's Wren (<i>Thryomanes bewickii</i>)	Probable resident, riparian habitats
Rock Wren (<i>Salpinctes obsoletus</i>)	Spring and fall resident (possibly winter), rocky habitats
Sage Thrasher (<i>Oreoscoptes montanus</i>)	Spring and fall
American Robin (<i>Turdus migratorius</i>)	Resident
Varied Thrush (<i>Ixoreus naevius</i>)	Rare, fall migrant, riparian habitats
Western Bluebird (<i>Sialia mexicana</i>)	Spring migrant
Mountain Bluebird (<i>Sialia currucoides</i>)	Resident
Townsend's Solitaire (<i>Myadestes townsendi</i>)	Fall and spring
Blue-gray Gnatcatcher (<i>Pipilo caerulea</i>)	Spring and summer, juniper habitats
Golden-crowned Kinglet (<i>Regulus satrapa</i>)	Fall and spring, juniper and riparian habitats
Ruby-crowned Kinglet (<i>Rerulus calendula</i>)	Fall and spring, juniper and riparian habitats
Loggerhead Shrike (<i>Lanius ludovicianus</i>)	Resident, shrublands
European Starling (<i>Sturnus vulgaris</i>)	Resident
Orange-crowned Warbler (<i>Vermivora celata</i>)	Fall migrant
Yellow Warbler (<i>Dendroica petechia</i>)	Spring migrant, possible summer resident, riparian areas

<u>Species</u>	<u>Observations</u>
<u>Common and Scientific Names</u>	
Yellow-rumped (Audubon's) Warbler (<i>Dendroica coronata</i>)	Fall and Spring, juniper and riparian habitats
Western Meadowlark (<i>Stumella neglecta</i>)	Probable resident
Red-winged Blackbird (<i>Agelaius phoeniceus</i>)	Probable resident
Northern (Bullock's) Oriole (<i>Icterus galbula</i>)	Spring and summer, riparian habitats
Brewer's Blackbird (<i>Euphagus cyanocephalus</i>)	Resident
Western Tanager (<i>Piranga ludoviciana</i>)	Fall migrant
Black-headed grosbeak (<i>Pheucticus melanocephalus</i>)	Spring migrant, riparian habitats
Lazuli Bunting (<i>Passerina amoena</i>)	Spring and summer, riparian habitats
Cassin's Finch (<i>Carpodacus cassinii</i>)	Fall and winter, juniper habitats
House Finch (<i>Carpodacus mexicanus</i>)	Probable resident
Pine Siskin (<i>Carduelis pinus</i>)	Rare, fall, juniper habitats
Lesser Goldfinch (<i>Carduelis psaltria</i>)	Spring and fall
Green-tailed Towhee (<i>Pipilo chlorua</i>)	Spring and summer, mountains
Rufous-sided Towhee (<i>Pipilo erythrophthalmus</i>)	Resident
Savannah Sparrow (<i>Passerculus sandwichensis</i>)	Uncommon, spring (possibly summer), shrublands
Lark Sparrow (<i>Chondestes grammacus</i>)	Spring and summer, shrublands
Black-throated Sparrow (<i>Amphispiza bilineata</i>)	Spring and summer, shrublands
Sage Sparrow (<i>Amphispiza belli</i>)	Spring and summer, shrublands
Dark-eyed (Oregon) Junco (<i>Junco hyemalis</i>)	Fall and spring
Chipping Sparrow (<i>Spizella passerina</i>)	Uncommon, spring (possibly summer)

SpeciesObservationsCommon and Scientific Names

Brewer's Sparrow
(*Spizella breweri*)

Spring and summer, shrublands, mountains fall and spring

White-crowned Sparrow
(*Zonotrichia leucophrys*)

Fall and spring

Song Sparrow
(*Melospiza melodia*)

Rare, Fall, riparian habitats

TABLE E-2

MAMMAL SPECIES LIST FOR THE AFFECTED AREA

This list represents mammals seen or otherwise known to occur in the area but it is not a complete list. No detailed mammal surveys have been conducted. Most small nocturnal mammals, therefore, are only identified to genus or general taxonomic group. "Sp". identified only to genus. "Spp." identified to genus, more than one species present. (Modified from JBR, 1989; 1990)

<u>Species</u>	<u>Observations</u>
<u>Common and Scientific Names</u>	
Long-tailed Weasel (<i>Mustela frenata</i>)	One individual seen near Fish Springs Ranch alfalfa fields
Badger (<i>Taxidea taxus</i>)	Sign common in Smoke Creek Desert
Coyote (<i>Canis latrans</i>)	Common resident
Bobcat (<i>Lynx rufus</i>)	Tracks in mountains, sightings west of area
Mule Deer (<i>Odocoileus hemionus</i>)	Large winter population, small resident herds in mountains
Pronghorn (<i>Antilocapra americana</i>)	Small, mobile populations
Antelope Ground Squirrel (<i>Ammospermophilus leucurus</i>)	Fairly common, active year round in good weather
California Ground Squirrel (<i>Spermophilus beecheyi</i>)	Uncommon, rocky areas
Least Chipmunk (<i>Tamias minimus</i>)	Uncommon
Pocket Gopher (<i>Thomomys, sp.</i>)	Burrows and mounds, meadow areas
Kangaroo Rat (<i>Dipodomys, spp.</i>)	Common, particularly in sandy areas
Beaver (<i>Castor canadensis</i>)	Long Valley Creek, and west of affected area
Wood Rat (<i>Neotoma sp.</i>)	Nests fairly common in juniper and rocky habitats
Muskrat (<i>Ondatra zibethicus</i>)	Young individual observed at Round Hole, Smoke Creek Desert
Porcupine (<i>Erethizon dorsatum</i>)	Individuals and tracks in juniper areas
Black-tailed Jackrabbit (<i>Lepus californicus</i>)	Common

Mountain Cottontail
(*Sylvilagus nuttallii*)

Uncommon in 1989,

Pygmy Rabbit
(*Sylvilagus idahoensis*)

Uncommon in big sagebrush

Spotted Bat
(*Euderma maculatum*)

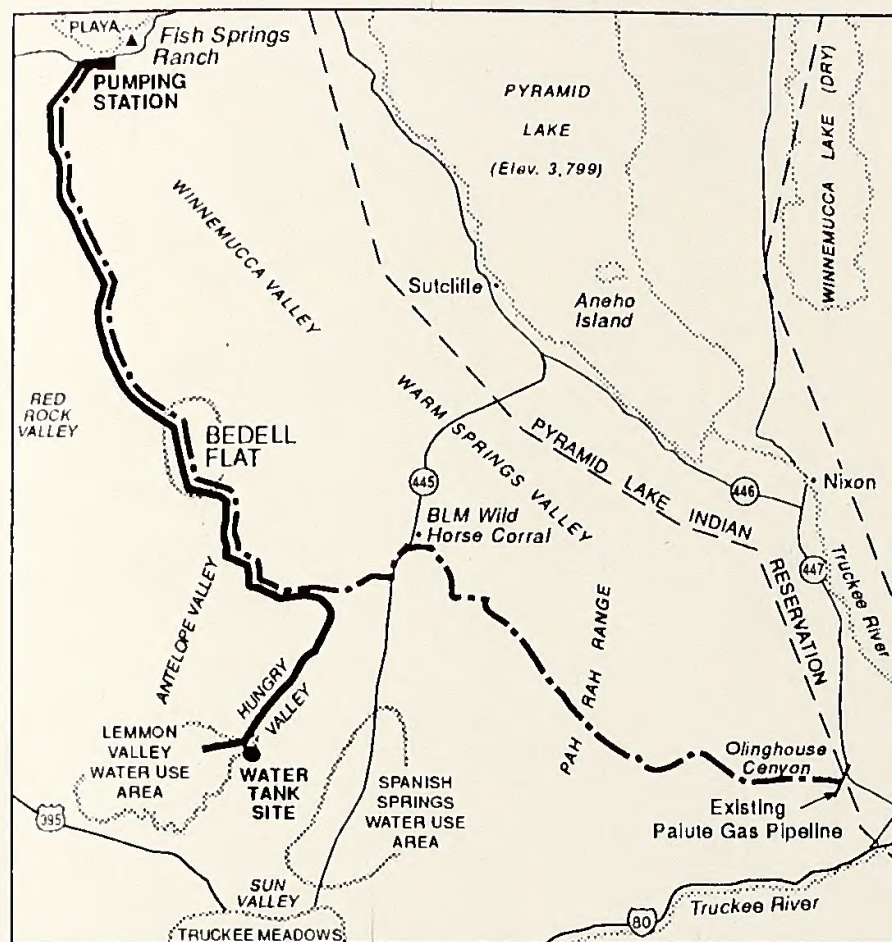
Not likely resident, but possible

TABLE E-3

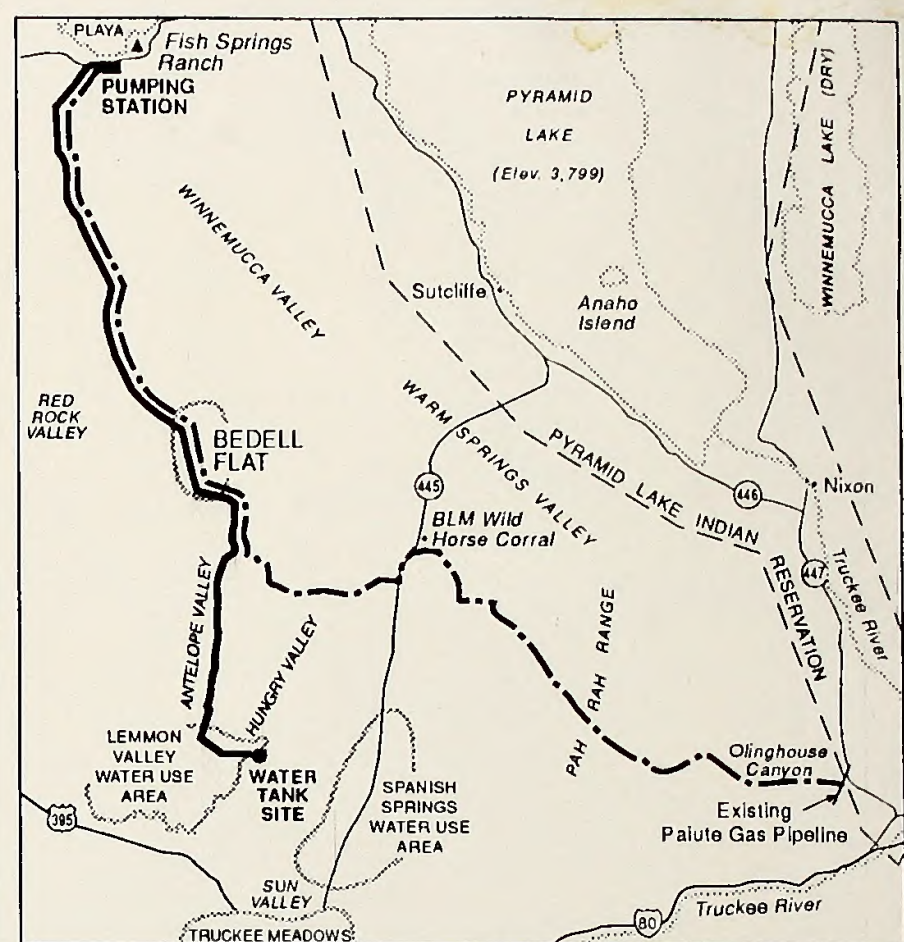
FISH, AMPHIBIAN AND REPTILE SPECIES LIST FOR THE AFFECTED AREA

This list represents fish, reptiles, and amphibians seen or otherwise known to occur in the area but it is not a complete list. No detailed herpetological surveys have been conducted. (Modified from JBR, 1989; 1990)

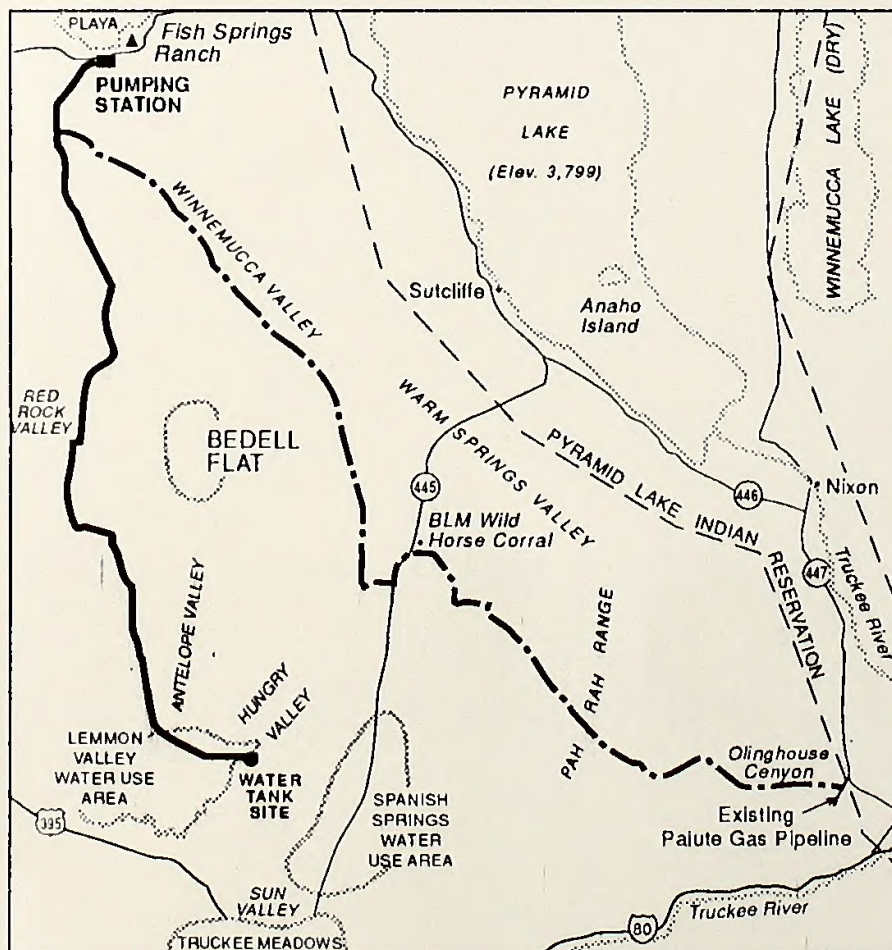
<u>Species</u>	<u>Observations</u>
<u>Common and Scientific Names</u>	
Cui-ui (<i>Chasnistes cujus</i>)	Endemic to Pyramid Lake
Lahontan Cutthroat Trout (<i>Oncorhynchus clarki henshawi</i>)	Present in Pyramid Lake, Walker Lake, other lakes and streams in the Great Basin
High Rock Spring Tui Chub (<i>Gila bicolor</i> spp.)	Previously inhabited High Rock Springs
Tilapia (<i>Tilapia</i> spp.)	Introduced to High Rock Springs
Pacific Treefrog (<i>Hyla regilla</i>)	In and near springs and ponds
Bullfrog (<i>Rana catesbeina</i>)	Heard calling at Round Hole, Bonham Ranch
Great Basin Spadefoot Toad (<i>Scaphiopus intermontanus</i>)	Tadpoles believed to be this species; pond in Smoke Creek Desert; Dry Valley
Lahontan Basin Leopard Lizard (<i>Gambelia wislizenii maculosus</i>)	Common in foothills south of Honey Lake Valley; Dry Valley
Nevada Zebra-tailed Lizard (<i>Callisaurus draconoides myurus</i>)	Foothills south of Honey Lake Valley
Mojave Desert Collared Lizard (<i>Crotaphytus insularis bicinctroes</i>)	Foothills south of Honey Lake Valley
Desert Horned Lizard (<i>Phrynosoma platyrhinos</i>)	Uncommon, Honey Lake Valley
Great Basin Western Fence Lizard (<i>Sceloporus occidentalis longipes</i>)	Rocky areas, shrublands
Nevada Side-blotched Lizard (<i>Uta stansburiana nevadensis</i>)	Shrublands, foothills south of Honey Lake Valley
Great Basin Western Whiptail (<i>Cnemidophorus tigris tigris</i>)	Shrublands
Great Basin Gopher Snake (<i>Pituophis melanoleucus deserticola</i>)	Several seen crossing roads
Great Basin (Western) Rattlesnake (<i>Crotalus viridis lutosus</i>)	One individual in western Smoke Creek Desert; and in Olinghouse Canyon



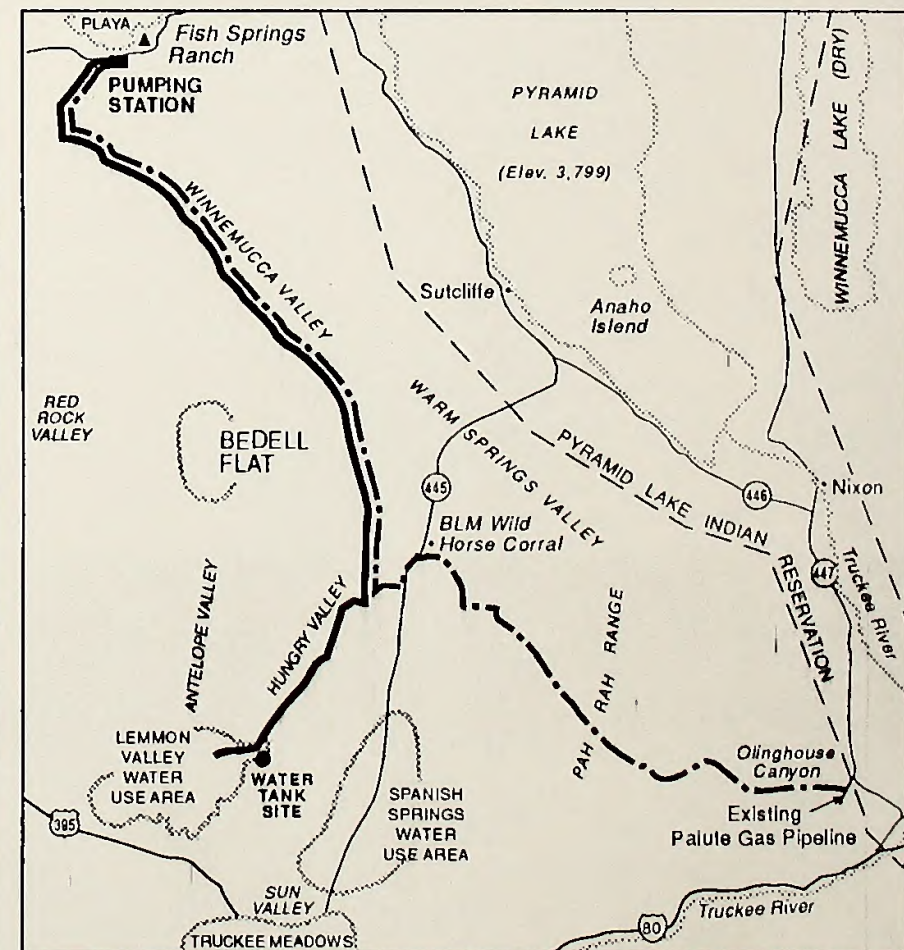
Proposed Bedell Flat Rights-of-Way



Antelope Valley Alternative



Red Rock Valley Alternative



Winnemucca Valley Alternative

LEGEND

- Water Pipeline
- Gas Pipeline

Proposed and Alternative Right-of-Way Routes



0 5
MILES

Form 1279-3
(June 1984)

8803031

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Bedell Flat pipelines rights
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ACRONYMS

acre-ft/yr	acre-feet per year
AUM	animal unit months
BOR	U.S. Bureau of Reclamation
BIA	U.S. Bureau of Indian Affairs
BLM	U.S. Bureau of Land Management
CFR	Code of Federal Regulations
cfs	cubic feet per second
CO	carbon monoxide
CDWR	California Department of Water Resources
COE	U.S. Army Corps. of Engineers
CDF&G	California Department of Fish and Game
CEQ	Council on Environmental Quality
EIS	Environmental Impact Statement
EPA	U.S. Environmental Protection Agency
FWS	U.S. Fish and Wildlife Service
GBUAPCD	Great Basin Unified Air Pollution Control District
gpm	gallons per minute
HMA	Herd Management Area
kg/day	kilograms per day
KOP	Key Observation Point
LRMP	Lahontan Resource Management Plan
mgd	million gallons per day
mg/l	milligrams per liter
MSA	Metropolitan Statistical Area
NAC	Nevada Administrative Code
NAAQS	National Ambient Air Quality Standards
NEPA	National Environmental Policy Act
NRHP	National Register of Historic Places
NRS	Nevada Revised Statutes
NWS	National Weather Service
NDOW	Nevada Department of Wildlife
NDEP	Nevada Department of Environmental Protection
NO _x	oxides of nitrogen, includes NO + NO ₂
pH	hydrogen ion concentration
PM ₁₀	particulate matter less than 10 microns in diameter
ppm	parts per million
psi	pounds per square inch
PSD	Prevention of Significant Deterioration
O ₃	ozone
ORV	off-road vehicle
RTC	Regional Transportation Commission (of Washoe County)
SCF	standard cubic foot
SCS	U.S. Soil Conservation Service
SHR	Significant Hydrologic Resources
SIP	State Implementation Plan
SO ₂	sulfur dioxide
SOP	standard operating procedures
TDS	total dissolved solids
ug/m ³	micrograms per cubic meter
USGS	U.S. Geological Survey
VMT	vehicle miles travelled
VRM	Visual Resource Management
WCDHD	Washoe County District Health Department
WCDPW	Washoe County Department of Public Works
WSA	Wilderness Study Area

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